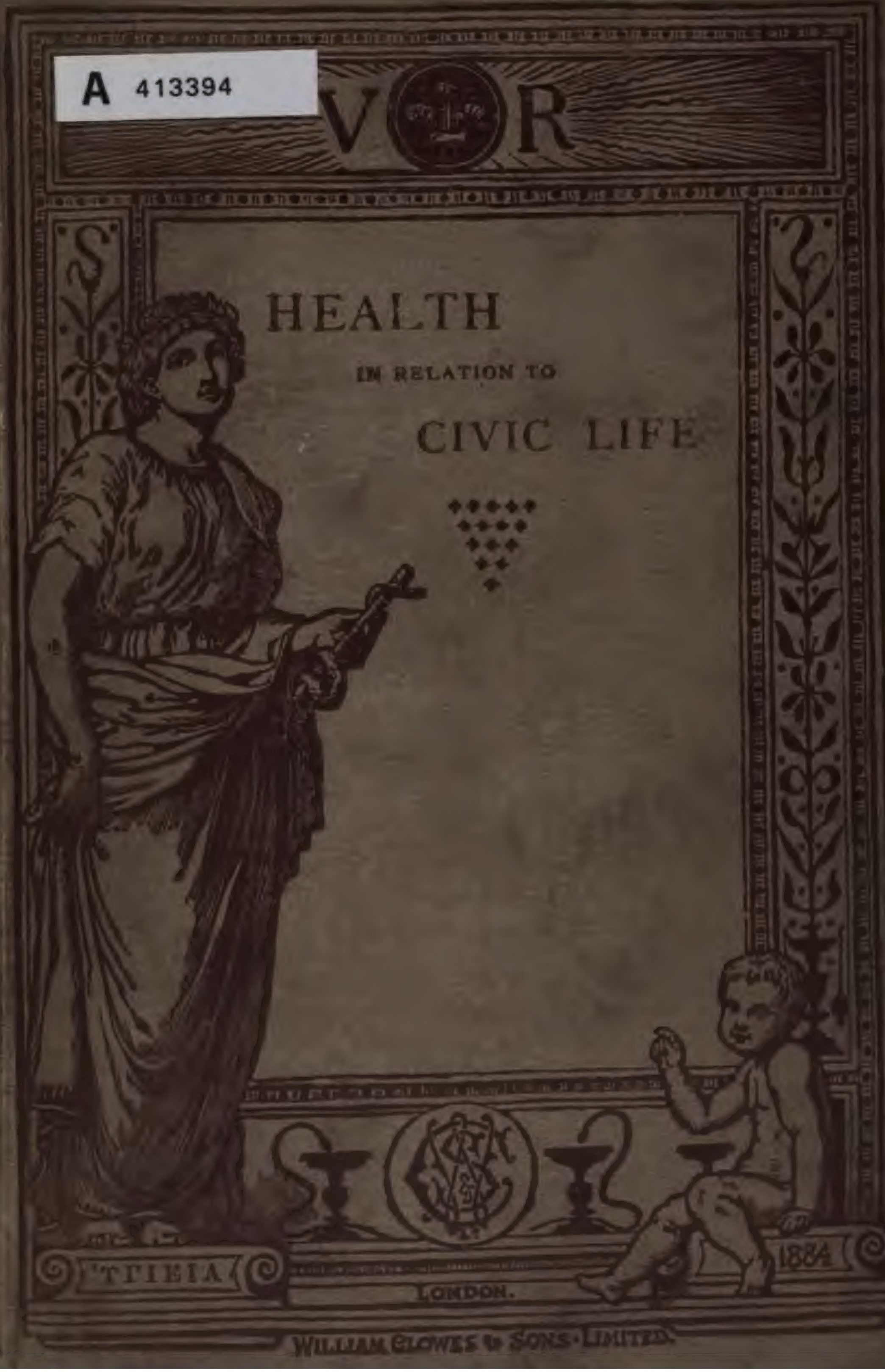
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HEALTH
IN RELATION TO
CIVIC LIFE
ΥΓΙΕΙΑ
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VOLUME VII.

HEALTH IN RELATION TO CIVIC LIFE.

HANDBOOKS.

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HANDBOOKS.

PREFACE.

THE importance of the subjects dealt with in the following pages and their intimate bearing upon the well-being of mankind will not be disputed. The question is rather whether public interest in them is, or can be, so aroused as to popularise their study.

Scientific people ought not to be supercilious in regard to the apathy and ignorance which still, unfortunately, prevail upon matters relating to public health. Most of what is here so clearly laid down and so well explained is the product of modern research and observation. Although the principles of these, as of all scientific truths, are old and eternal, the need for their application to our daily wants has only been realised since the growth of population has brought about evils which could no longer be ignored by the people, or suffered to escape State interference.

The clustering of many households in our urban community must, from the first, have led to the establishment of common agencies for those services in connection with the dwelling-house which are discharged, in our modern parlance, by "the local authority," at the cost of the "local rate."

Drainage of houses, surface drainage, scavenging, paving and lighting of streets, water supply, prevention or extinction of fire, &c., must have been provided by each householder for himself if he had not a municipality to furnish such conveniences more cheaply and more comprehensively at the common charge—a charge readily borne as lending value to each separate habitation.

The "*Cloaca Maxima*" still remains at Rome to show that such things were required and provided two thousand five hundred years ago; but we need not trace the history of municipal sanitary functions from so distant a date.

The greater part of that which is dealt with in the accompanying Handbooks is regulated by statutes passed within the last thirty years, originally through the agency of the Privy Council and the Home Office, more recently through that of the Local Government Board, which has become since 1872 the Ministry of Public Health in this kingdom.

The Royal Sanitary Commission paved the way for this great change in our system of Local Government; and the passing of the Public Health Act in 1875, followed in the subsequent year by the Sale of Food and Drugs Act and the Pollutions of Rivers Prevention Act, marked a further stage in the development of the new administration, and in its powers for good.

In reference to the Public Health Act, the late learned Mr. Lumley, Q.C., remarks (in his annotated edition of that statute) as follows:—

"This statute is that upon which, for the future, the powers and duties of all sanitary authorities in England will depend. It consolidates and collects into one compass a number of detached and isolated statutes, and presents the whole in one connected code to those numerous bodies who are called upon to exercise sanitary functions, for their daily use. It cannot be expected to be a final measure, but the present Act is in itself so extensive, so complete, and for the most part so explicit, that it must remain the substantial code of the sanitary law of England for many years."

The writers of several of this collection of Handbooks will be the first to recognise the inestimable service rendered to sanitary science and practice in this country by Mr. John Simon, C.B., as Medical Officer of the Privy Council and of the Local Government Board. The nature and causes of typhoid fever, for example, may be said to

have been revealed by the enquiries of himself and the able staff of inspectors by whom he was for many years surrounded. While in the reports issued by his authority, are to be found indications of remedial measures and modes of treatment which are now universally accepted as axioms and commonplaces.

Government by inspection, or under the conduct of inspectors, can never be, in the vulgar sense of the term, popular in this country; but it would be an evil day for the cause of public health if its interests were no longer to be watched, and if local authorities were no longer to be advised and assisted in their efforts after its amelioration, by the skilled staff of engineers and medical officers whose services have now been made available by the wise policy of Parliament through the administration of the Local Government Board.

G. SCLATER BOOTH,
Chairman of Jury No. VIII.

July 8th, 1884.

OUR DUTY

IN RELATION TO HEALTH.

BY

G. V. POORE, M.D.

"England expects that every man will do his duty."

CONTENTS.

OUR DUTY IN RELATION TO HEALTH.

CHAPTER I.

THE HOUSE.

A DISTINGUISHED general officer, who ruled his family with something akin to military discipline, never failed to severely reprove his children when he saw them endanger their health by any childish imprudence. He would say to them, "Remember that I love you most when you are well. When you are ill you become a trouble and an expense. It is your duty, therefore, to try to keep yourselves well. Knowing your duty, do it."

Although, happily, we have been trained to extend sympathy and help to the sick and afflicted, it is nevertheless true that the sick and afflicted are a trouble and an expense. We ought all to remember this. We ought all of us to try our utmost to keep well. It is our moral duty not to tax the patience, sympathy, or pockets of loving friends and relatives if we can possibly avoid doing so. Health is the greatest of all blessings. The sound mind, in the sound body, is the chief thing to be desired. Intellectual and moral superiority follow in the wake of bodily health. Health and happiness are ever linked together, and seldom exist excepting when thus linked.

The health of a nation or community depends upon the health of the units which compose it. General moral and intellectual progress depends upon the moral and

intellectual progress of individuals. Since "National Health" (both moral and intellectual) depends on the health of individuals; patriotism, affection, and the sense of self-preservation ought equally to prompt the individual to try to keep well.

The health of the individual is mainly, though not entirely, in his own keeping. If every individual did his duty in relation to health, our health would ultimately be entirely in our own keeping; and we should no longer run the risks, through inheritance and infection, which we run at present. If the individual lose his health it may cause loss of health to others. The watching, anxiety and fatigue which sickness entails upon loving friends and relatives has undermined many a constitution. Infectious disease may infect those we love best, and in some instances may be transmitted to generations yet unborn.

No arguments are needed, therefore, to show that the first and highest duty of every individual is to keep himself healthy. If he succeed in doing this, he will be in a fair way to perform his duty to his neighbour and himself. If health be lost it is difficult to perform either of these duties adequately.

In these days the individual is in some danger of forgetting that his first duty is to keep himself well and to take care that he is not the cause of disease in others. The carelessness and apathy of individuals has necessitated the formation of "Boards" and "Sanitary Authorities;" and we are too ready to give over our individual responsibility to the keeping of a board and to allow "rates" to take the place of morals. Sometimes it would almost seem as if the individual thought that he had some moral right to be kept healthy rather than to try to keep himself healthy. It is difficult, for instance, to see what right a man has to think that he is at liberty to be absolutely filthy in his house and habits, and to call upon someone else to cleanse his augean stable, and to have such cleansing done at the expense of a rate which too often falls more heavily on his neighbours than himself.

Such is the condition of things which exists in big cities. Individuals, for the sake of profit, crowd houses together, so that the possibility of anything like cleanly life is impossible. And when the filthiness which we have watched growing under our very eyes, and which we have made no effort to stop, reaches a pitch in which the danger is too obvious to be neglected, we expend vast sums to be rid of the nuisance; and, too often, in the act of getting rid of one we create a second which is only less dangerous than the first.

It is, it will be admitted, clear enough that if builders of houses and owners of property had been made to do their duty in the past, the disgraceful overcrowding which exists in some of our big cities would never have occurred; and the troubles which we are encountering in connection with sewage, water supply, and the dwellings of the poor, would never have arisen. Through avarice or ignorance, owners and builders have failed to do their duty spontaneously, and no compulsion has been put upon them. The more crowded the "Building Estate," the greater the profit to owner and lessee. It has been an easy and profitable thing to build houses side by side and almost back to back, and with no curtilage whatever, each house stuck over a sewer like a sort of sewer gasometer. Tenants have thought such houses cheap, and have failed to reckon loss of health, rates, and doctor's bills among the annual costs which dwellings such as these entail.

Although we recognise the evils which have arisen from our negligence in the past, we make no serious attempt to stop the formation of such evils. The past generation left us a legacy of overcrowding with which we are still grappling unsuccessfully, and we shall leave a still worse legacy to posterity. It might have been thought that railway and telegraphic communication would have diminished overcrowding, by making it more easy to go and communicate from point to point; but, as a matter of fact, the reverse has been the case, and railways have merely served to swell the size of places already overgrown.

The great difficulty of dealing with overcrowding is this,

that so many people make a profit out of it. Among these are :—

1. Owners of property, whose ground rents are proportioned to the crowding.

2. Speculative builders, who find it more profitable to build a terrace of fifty houses than fifty detached houses.

3. All the tradesmen who supply builders with materials.

4. Water Companies, whose profits depend upon having a large number of customers in a small area.

5. Gas Companies, for similar reasons.

6. Railway Companies, to whom the advantages of big centres of population are obvious.

7. Tradesmen generally, because their profits are necessarily proportioned to the closeness of population.

Thus overcrowding is a source of apparent profit to almost every section of the Community ; and until we get "Boards" composed entirely of men who have minds which rise superior to all considerations of immediate profit, there is but little chance of the owner and builder being made to do their duty.

When a district has become overcrowded so that healthy filth disposal is impossible, then comes the gigantic sewerage scheme, which only increases the overcrowding, by making it possible to pack houses together even closer than before, and we usually finish off in a worse plight than we were in at the commencement.

A simple Act, applicable to the whole kingdom, making it imperative on builders to provide a sufficient curtilage to every house and to provide for filth disposal, would stop the formation of those insanitary conditions, which, being formed, we seem powerless to correct. Prevention is better than cure.

In big centres of population, where water-supply, lighting, and filth disposal have passed to the control of a central authority, the responsibility of the individual is at a minimum. If, therefore, he is compelled to live in an overcrowded city, the most he can do is to keep his house as clean and wholesome as circumstances and the plumber

will permit; to obey the bye-laws which the central authority may seem fit to enact for his benefit; and to do his duty as a citizen by returning the most honest and least self-interested men to represent him on the "Board."

There are many rural and semi-rural places which seem inclined to imitate the great centres, and in which the controlling authorities are more ready to push expensive sanitary works than to seek to compel individuals to do their duty. I shall try to show in the present volume that if individuals, in rural and semi-rural places, would recognise their moral responsibility in relation to health, great schemes of sewerage and the like, which are never an unmixed good but often an unmixed evil, would never become necessary; and their construction should never be permitted merely to serve the interests and profit of companies or individuals.

By those who are content to live simply, the conditions of healthy living are easily attained.

A cottage (*ornée,* if you like) built on a slight eminence or on the slope of a hill, well exposed to the sun, and with a quarter of an acre of land, is no utopian idea. The idea is capable, be it observed, of contraction or expansion, but if the individual is to be *quite* independent of others for his healthy surrounding, a small plot of garden ground is absolutely essential.

The foundations of this modest house must be solid and dry, the walls thick, the windows big, and the roof water-tight.

There must be neither cesspools nor sewer, which are great and acknowledged causes of sickness. No filth or refuse must be allowed to accumulate, but it must be returned *every day* to the soil.

The rain water which falls upon the roof should be kept for washing and cooking, if not for drinking; and I may remark, parenthetically, that there is no reason why rain-water should not be collected in an ornamental vessel as well as in the dirty-looking water-butt, or hideous tank which is now too much in vogue. It is far better to have an ornamental water vessel in a prominent place where it

can be easily inspected than a hideous receptacle poked away in some odd corner where it is too often forgotten.

There are one or two points in the construction of dwellings which are of importance, and which do not receive sufficient attention from architects.

One is to have a maximum amount of light precisely in those places where filth is most likely to accumulate, in order that the filth and dirt may be easily detected.

Another is to let waste water be discharged at the highest level possible, in order that its filtration by gravitation through the earth, or any other suitable filter, may be easily arranged.

A third is not to allow the staircase to become a channel whereby the used air of the ground floor may float up to the first floor. Staircases should be shut off from the ground floor apartments by means of a door.

Many of the details of this simple dwelling will be dealt with in subsequent chapters. It will be noted that what has been sketched is within the reach of very moderate means. It is too simple, I fear, and will not be approved of by those who have longings after more pretentious residences and more artificial modes of existence.

Health depends upon our obeying the beneficent laws of nature; and the rule of nature which most affects our health is this, *that all refuse matter shall be restored without delay to our mother earth*, who will receive it gratefully, and give back a glorious dividend. The greater number of our sanitary troubles are due to the neglect of this law. It will be noted that it is very cheap to live healthily. In the dwelling I have supposed there would be no sewer-rate, no water-rate, no plumbers' bills, very little sickness, and a good return from the well-cultivated and well-nourished garden.

A distinguished physician and sanitarian has drawn a picture of a city in which the laws of health are strictly obeyed; he called his imaginary city the City of Hygeia. A City of Hygeia is hard to attain, and would involve immense expenditure and endless watching. A healthy

cottage (call it Hygeia if you like) is easily attained, and is the cheapest dwelling imaginable for a civilised man.

Without cultivation of the soil there can be no high standard of health. The gardener and the farmer are, so to say, the right hand men of the sanitarian. What the householder wants to be rid of, the tiller of the soil is ready to take. If the householder tills a bit of soil for himself all difficulties are at an end; if he do not, his difficulties begin. If the refuse of a single house be put on its own garden, there is no difficulty. If the refuse of a group of houses be taken to a neighbouring field or garden, the difficulty is slight, but the return is less, because the expense of transport has to be borne, and it must be remembered that refuse matter will not bear the expense of much carriage. If the refuse of a big town is taken to one spot, the delay in collection and other difficulties increase, and it is found that the expense of transport eats up the profit. It is evident that refuse should be utilised at the *nearest* available spot. If the refuse of London had been treated in this way, and had been carried to all the points of the compass for utilisation instead of being collected at one spot, it would probably have proved to be less of an incubus than it is at present.

This is the age of centralisation, of co-operation and big schemes; but in the matter of refuse disposal big schemes have not proved successful, for the very obvious reason that the greater the distance refuse is transported the greater the loss. Refuse is valuable if used on the spot and immediately. Storage and transport diminish the profit from refuse, and dilution destroys it altogether. Country towns would, it is tolerably certain, do well to carry their sewage to many points rather than one, and by so doing they would simplify their difficulties, and would be enabled to make use of the natural formation of the surface. It is tolerably clear that all sanitary authorities should cultivate the soil. Some have embarked in big schemes of sewage farming, but the success of these schemes has often borne an inverse proportion to their size. Every town should be

planted, and perhaps some day our country towns will be beautified by sanitary authorities instead of being simply disfigured. If the streets and roadways were planted, and if the trees thus planted were nourished with some of the refuse of the town, our country towns would gain in appearance and healthiness. At least, the putting of refuse matter to its proper use might convey a valuable lesson to the inhabitants. I know one country town, the inhabitants of which subscribed to plant a beautiful walk which a bygone benefactor had given to them. The trees subscribed for were merely stuck into a poor chalk soil, and there they are after the lapse of twenty years all stunted and miserable from starvation; and yet the Urban Sanitary Authority has never seen fit to give these poor trees a dose of what they need, although they are quite ready to enter into schemes for conveying refuse in pipes, far away from where it is needed, and to pump it, and stir it and filter it, and precipitate it, and evaporate it, and in short do everything with it except the right thing.*

* Since penning the above I have had an opportunity of seeing the realisation of a perfectly healthy house. This is the small Union workhouse of Penmaen, in the peninsula of Gower, South Wales. The situation, to begin with, is magnificent, though bleak and exposed in winter to pitiless storms. There is neither drain nor cess-pool, and the house is spotlessly clean and entirely without hangings and carpets which harbour dust and filth. There are (on an average) 20 inmates, of whom 9 are children and 4 officials—24 persons in all. The solid filth is mixed with ashes (an ash closet being used), and is moved every day on to the garden, and the whole of the bed-room and cooking slops of the 24 persons are poured (every day) on to a little slip of ground 24 yards long and 4 yards wide, *i.e.*, 96 square yards or 4 square yards per head. This strip, which we saw during wet weather in February, had no appearance of being over-dosed with liquid, and probably would have taken twice or three times as much without difficulty. The crops raised in these workhouse gardens are very large, and the cost of maintenance of the inmates (food and clothing), is 3*s.* 6*d.* per week per head, or 9*l.* 2*s.* 0*d.* per annum. The inmates look cheerful and healthy, and the children fat and rosy-cheeked. A glance at the returns of death and sickness were interesting. The sickness was limited almost entirely to the old people, and these old people reached great ages. Since 1863 (which was the earliest return accessible) there had not been a single death among the children, the

It would almost seem that living is healthy in proportion to the simplicity and economy which is observed. Almost all expenditure on needless luxuries in the house involves some risk ; and in order to illustrate this point it will be well to glance at the modern dwelling fitted with what are termed "the latest sanitary improvements."

A very excellent work, entitled " Our Homes and how to make them healthy," has lately been published by Messrs. Cassell and Co., a firm which has done great service to the nation in disseminating popular knowledge. This book is edited by Mr. Shirley Murphy, the medical officer of St. Pancras, and the writers of the several articles are each of them leading men in their professions.

Mr. Thomas Eccleston Gibb, who writes on the legal liabilities of householders, warns us that "there is no part of a house where builders are so likely to 'scamp' their work as the drainage, and they are probably in that point under the least amount of supervision by public authorities. A local surveyor may order the work to be done in a particular manner ; but the work is done and covered up in his absence, and the nicely-worded bye-laws which hang in the builder's office are not more likely to be looked at by the builder, than are the drains, when buried beneath the ground, by the officer appointed to see those bye-laws carried out. Nothing short of an alteration in the system can remedy this great sanitary defect."

Mr. Eassie, C.E., in a very able article, tells us of some of the difficulties and dangers of house drainage, and warns us :—

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youngest who had died having been eighteen years of age ; and in reply to my enquiry as to whether there had been either typhoid, diarrhœa, diphtheria, scarlatina, whooping cough, or measles, the master informed me that there had been none of these diseases since he had held office (16 months), and that he had not heard that any had occurred previously.

And yet, be it remembered, this house stood in a situation exposed to every wind that blows, and in fact was such a house as the majority of mothers would consider a very undesirable winter-residence for young children.

1. That the pipes sent by the maker are often so bad that the unloading of them at the railway station must be superintended by someone who represents the interests of the purchaser, and that the individual pipes must be inspected, and the bad ones rejected and returned to the manufacturer at his expense.

2. The chief defects of pipes are, that they are badly fired, too brittle, too rough on the inside, too thin and ill-fitting at the sockets.

3. The laying of pipes is no easy matter. The ground may get sodden and sink away beneath, and thus the levels may get wrong and stoppages occur. Again, workmen will often maintain a level by means of wooden wedges, and these in time, rot, and the proper level is lost.

4. The joining of pipes involves great care, the sockets must fit and the cement be good; and we are warned that if the cement projects into the interior of the pipe the flow through the pipe is impeded and dangerous stoppages may occur. Again, it is common to make a junction between a big pipe and a small one without a proper diminishing pipe, and then leakage is sure to occur, and the earth gets sodden.

5. If pipes be laid (as often is the case) before the heavy building work is finished, they run a great risk of being broken by the falling of heavy bodies on the earth above them.

6. Pipes are so liable to become disarranged in some way that it is never safe to have them beneath a house When they pass through the wall of a house they are very liable to break when the house settles; stoppage will occur, and the drainage will be penned back, and become a source of danger.

[N.B. Houses are very liable to settle when they are built, as often is the case, on heaps of rubbish and rotting refuse.]

7. Pipes are very liable to get choked, the chief causes being, (*a*) defects of manufacture or workmanship as indicated above; (*b*) collections of sediment where the leve

becomes deranged; (*c*) collections in syphon bends, which, we are informed, are "the best abused article in a line of drainage;" (*d*) the congealing of fat from the kitchen; (*e*) the invasion of pipes by the roots of trees—for trees have a nasty trick of driving their roots where they can get nourishment.

8. "Grease traps" are necessary, especially when the scullery sink is at the farthest point from the sewer as it is in the majority of London houses. These grease traps must be cleaned every two or three months, because they generate, during decomposition, "very disagreeable smells."

9. Having laid our drains, our next efforts are directed to keeping back the foul air which must accumulate in a foul place; "traps" are necessary. Their name is legion, and we are warned that the commonest of all (the bell-trap) is "most reprehensible."

10. Having finished with drains, we next turn our attention to the "soil-pipes." These are too often made of badly-socketed earthenware pipes, and when tested they are not unfrequently found to leak at every joint, and to be broken at the foot.

11. As to the proper material for soil-pipes, we are told, (*a*) that zinc is too weak and must not be used; (*b*) that cast-iron is not a bad material, but "the vilest attempts at making a joint are perpetrated;" (*c*) lead is recommended as the best material, but then the lead must be thick enough, and the jointing perfect.*

12. The joints of soil-pipes must not be "slip-joints, where one end of a pipe is slipped into the end of another and the space filled up with *no matter what!*"

13. The soil-pipes must be properly fastened to the walls. We are told how, out of ten stacks of soil-pipes examined in a northern hospital, there was scarcely a sound joint found from want of this precaution.

* During a debate on the sanitary defects in houses which lately took place at the Parkes Museum, a story was told of an enterprising American who made a soil pipe of old meat tins which he soldered together. The jointing in this case was sadly defective.

14. Then the soil-pipe (if it can be made air-tight) needs artificial ventilation, and the ventilator of the same diameter as the soil-pipe must be carried to a height of at least four feet above the highest window, and we must take care lest the birds come and build in it.

15. "It is constantly a matter of surprise and disgust to notice, especially in houses built for the working and middle classes, how often rain-water pipes are made to do duty for soil-pipes as well; how often the waste-pipes of baths and sinks are taken into such combined pipes; how always these pipes communicate at the foot with the house-drain, not disconnected from the sewer in any way; and how, very frequently, such pipes, doing double duty, terminate level with the top windows, giving off vaporous effluvia into the warmer room whenever the top sash is pushed down or the bottom one lifted" (p. 638).

16. It is necessary to disconnect the soil-pipe and the house-drain generally from the sewer, in order that the air of the sewer may be kept from the house, and a current of air circulate in the house pipes. The means of dis-connection are complicated, and the ground plans of some of these disconnecting schemes remind me in appearance of some of Euclid's propositions. They require an expert for the proper understanding of them, and we are warned that "Far too frequently after an ordinary builder has produced what he terms disconnection and ventilation on modern lines, the bulk of the work has to be re-arranged a considerable expense."

17. Pipes and drains are so frequently stopped that i is advisable for the owner of a large house to keep on th premises proper cleansing rods and forcing gear.

Mr. Eassie having given a number of warnings as t what *may* occur in consequence of ignorance, bad work manship, or accident, Dr. Corfield takes up the running and from the store of his ample experience tells us wha *has* occurred. Dr. Corfield tells us:

18. How rats make runs from the drains beneath ou houses and invade the house and how they will run from

a defective drain in one house, beneath a parti-wall, and up the drain of the next house.

19. How he has found cesspools leaking into wells.

20. How drains have been found with an insufficient fall, or even sloping the wrong way.

21. How drains have been found not jointed at all, or jointed the wrong way, so that they must leak.

22. How it has been attempted to take a drain round a corner by means of two straight pipes, meeting at an angle instead of a proper curved pipe, and how the open angle necessarily leaked.

23. How junctions are made by means of clumsy holes roughly knocked in a big pipe, in order to take the end of a small one, and how blocks and leakage are thereby brought about.

24. How the sewer air comes up the kitchen sink.

25. How rain-water pipes and even special ventilating pipes bring sewer air to the attic windows.

26. How the *upper end* of a soil pipe has been allowed to remain open, and terminate *inside the house*.

27. How the *lower end* has been found to have no connection whatever with the drain.

28. How soil pipes have been found traversing the wall of a larder, and how they have been perforated by the hooks and nails on which the mutton is hung.

29. How traps are often a delusion and a snare, and how in addition to the Bell-trap the next commonest, the D trap, is worse than useless.

30. How lead quickly wears out and gets perforated.*

* In the Parkes Museum is an interesting collection of old lead sanitary fittings, which have been removed from houses, and which have been the cause of more or less illness in consequence of their becoming perforated, and thereby admitting sewer air to the house.

Water-traps are of only partial use in keeping foul gases out of houses. The foul gases of the sewer are absorbed by the water on one side and given off on the other, and if there be foul gas in the sewer, the water of the trap is sure to become charged with gas quite independent of differences of pressure in temperature. If the water in the trap evaporates (as is sure to happen in any sink or closet which

31. How sewer air may come up the waste pipe, overflow pipe of the cistern, and contaminate the drink water.

32. How "syphon bends" get emptied by suction choked by deposit.

33. *How pan closets and D traps get plugged a "the container" foul.

34. How valve-closets, solid plug-closets, wash-closets, and Hopper-closets are each liable to their spec and peculiar defects.

35. How special cisterns are necessary for the service the W.C., and how epidemics of typhoid have arisen fr neglect of this precaution.

36. Finally, we are told how "foul air often travels ab houses by most unexpected channels. Rat-runns h already been mentioned; but besides these it travels un floors, behind panelling and wainscoting, along ventilat shafts, through defective flues, and even through the tu in which bell wires are carried, through which foul sm from the basement, and still more frequently, the produ of the combustion of gas-burners, often ascend into roo upstairs."

The above catalogue of common dangers in mod houses seems to show that as all "modern sanitary provements" are liable to wear and tear, the danger aris from them (even assuming that they are all, to begin w

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is little used, and is in some forgotten corner), or if the water is suc out by the flow of water past it, from some pipe above, then sewe has of course free access through an untrapped pipe. We can n see the state of our "traps," and we can only infer (and often wron that they are sealed.

A distinguished physician speaking at the Mansion House, in ai the Parkes Museum, some two or three years since, spoke of the trap as the "double D trap, because it deals out Death and d seminates Disease."

* The writer has seen the "safe" of a pan closet, which is intend to catch slops which accidentally spill over, perforated by a bell wi and the spilt slops soaking along the track of the wire.

perfectly made and perfectly fitted) must be proportionate to the quantity used.

They all cost money, many of them are very expensive, and they all add to house-rent, or diminish the profits of the landlord.

When there is a small garden they are *all of them* unnecessary, and it is perfectly idle to contend that there is greater decency in the use of water apparatus than in the so-called dry methods. Dry methods do not open the door for the profit of patentees and others; but if a little of the ingenuity which has been devoted to the manufacture and subsequent exclusions of sewer air had been devoted to the easy use of dry methods of filth manipulation, many lives would have been saved and much money also.

It is the fashion of the present day to bring all that is nasty into our houses, even though those houses stand in hundreds of acres of park land. And Sir Gorgius Midas, who never spends a shilling on his library, will spend hundreds or thousands in order that he and his household may be in constant danger of sewer gas.

If Jonathan Swift had lived on into the nineteenth century, assuredly Lemuel Gulliver would have been made to take a voyage to the modern Hygienic Laputa; and possibly Swift's wit and satire would have been able to bring people back to the straight road from which they have gone so dangerously astray.

Great cities which have got fast stuck in a sanitary quagmire must perforce pay large sums to have their troubles lessened; and to that end it is to be hoped that the almost endless clauses of Sanitary Acts will be of use. The moral duty of the individual in a city is to obey the law and assist in every way in its proper execution.

In rural and semi-rural districts, the individual ought no more to ask others to keep him clean than he asks others to feed him, or clothe him. He ought to take a pride in keeping his house wholesome and clean, and he ought to receive every encouragement from the authorities if he do so.

All houses should be inspected *at regular intervals* officers who are independent of local considerations, and ought to prevent nuisance and not wait till it become glaring that neighbours are bound to take the unplea course of complaining. Under the present system merely shut the stable door after the horse has been stc i.e., we only abate a nuisance after it has done its miscl

If filth has to be removed from premises by the pu authorities, then such removal should be paid for—by owner in the case of weekly tenants, or by the occupie the case of yearly tenants and leaseholders, or freeholde

All water-closets should be taxed, because they ne sarily leave filth to be dealt with by the public authori If charges were equitably levied, then one of two th would happen: either (*a*), the work of the public autho would dwindle to a minimum; or (*b*), those who trust to public authority to keep them clean would pay more t those who keep themselves clean.

The opposite course is too often taken. Compul connection with sewers is often insisted upon even in r places where there is no necessity for such compuls and good citizens are often inordinately taxed to cle the filthy property of bad citizens.

An equitable adjustment of Sanitary Rates seems t the first essential for encouraging the individual ho holder to do his duty. This is more essential now t formerly, because by the Rivers Pollution Act all must be cleansed in some way before it is allowed to t its course along the lines of natural drainage to a river.

CHAPTER II.

WATER.

WATER is an article of first necessity to all of us. Without pure water there cannot be health. Pure water has served moralists of all times as a symbol of purity. The Christian Sacrament of Baptism is an instance of this.

Our moral responsibility with regard to water should be to regard its purity as something too sacred to be defiled. In this Christian land, however, there is scarcely a water-course which is not polluted, and many of our loveliest rivers have been wantonly converted into sewers.

In his introduction to "The Crown of Wild Olive," professor Ruskin gives an eloquent description of our swinish and disgraceful apathy with regard to water. The passage is so beautiful, that I make no apology for quoting it in full.

"Twenty years ago there was no lovelier piece of lowland scenery in South England, nor any more pathetic in the world, by its expression of sweet human character and life, than that immediately bordering on the source of the Wandle, and including the low moors of Addington, and the villages of Beddington and Carshalton, with all their pools and streams. No clearer or diviner waters ever sang with constant lips of the hand which "giveth rain from heaven;" no pasture ever lightened in spring-time with more passionate blossoming; no sweeter homes ever hallowed the heart of the passer-by with their pride of peaceful gladness—fain hidden—yet full confessed. The place remains (1870) nearly unchanged in its larger features; but with deliberate mind I say, that I have never

seen anything so ghastly in its inner tragic meaning- in Pisan Maremma—not by Campagna tomb—not b sand-isles of the Torcellan shore—as the slow steali aspects of reckless, indolent, animal neglect over delicate sweetness of that English scene. Nor is blasphemy or impiety, any frantic saying or go thought, more appalling to me, using the best pow judgment I have to discern its sense and scope, tha insolent defiling of those springs by the human herds drink of them. Just where the welling of stainless w trembling and pure, like a body of light, enters the p Carshalton, cutting itself a radiant channel down t gravel, through ways of feathery reeds, all waving, it traverses with its deep threads of clearness, lik Chalcedony in Moss-agate, starred here and there the white Grenouillette; just in the very rush murmur of the first spreading currents, the human wre of the place cast their street and house foulness; of dust and slime and broken shreds of old metal, and of putrid clothes, which, having neither energy to away, nor decency enough to dig into the ground, thus shed into the stream, to diffuse what venom will float and melt, far away, in all places where meant those waters to bring joy and health. And little pool behind some houses farther in the village, another spring rises, the shattered stones of the well of the little fretted channel which was long ago buil traced for it by gentle hands, lie scattered, each from under a rugged bank of mortar and scoria, and brickl refuse, on one side, which the clean water, neverth chastises to purity; but it cannot conquer the dead beyond; and then circled and coiled under festering the stagnant edge of the pool effaces itself into a sl black slime, the accumulation of indolent years. H dozen men, with one day's work, could cleanse those and trim the flowers about their banks, and make breath of summer air above them rich with cool balm every glittering wave medicinal, as if it ran, troubled

by angels from the porch of Bethesda. But that day's work is never given, nor, I suppose, will be; nor will any joy be possible to heart of man for evermore, about those wells of English water."

If poetry may be defined as the art of conveying absolute truths in the most beautiful and forcible language attainable, of at once compelling the intellect and gratifying the senses, then the above passage must take a high rank among short English poems, for its beauty is equalled by its absolute matter-of-fact truth.

Unfortunately for the purity of English waters, the Public Health Act of 1848 compelled the emptying of town sewerage into rivers, and we are still taught that one of the chief tenets of our sanitary creed should be to dirty as much water as possible in washing away from our houses filth which ought to be buried. As a consequence of this, pure water is becoming daily more difficult to get, and now-a-days it is considered safer and better to drink water—hard, charged with carbonic acid, and deficient in oxygen—which has been raised at infinite cost from the depths of the earth, than to drink of the "brook which babbles by," with every bubble freshened by the air and charged with its maximum amount of oxygen. The reason for this is that the brook has almost certainly been fouled by receiving the filthiness from dwellings nearer to its source, and the natural consequence is the reflection that if the brook has already been fouled, a little more fouling can do no harm, and thus the brook gathers sewage as it flows, till, having passed through sundry towns in its course, it flows out to sea a murky, lurid, seething, stinking sewer.

We all of us deplore this state of things, but few of us in thinking of the cause of such filthy impurity ever pause to put to ourselves the solemn question, "Is it I?" We inveigh against the "Board," we say that such a state of things is disgraceful, we shut our eyes to the fact that the disgrace falls upon ourselves as well as others; and even though we may be favourably circumstanced for doing our

duty towards the water-courses, the pangs of consc are seldom sufficient to make us stop our quota of tions ; at least to do our own duty, and, doing it, set a example to others.

Richard the Second (whose advisers probably re bered the epidemics of "the Black Death" in the of his grandfather) passed an Act in 1388 which impc penalty of twenty pounds (worth how much of our mo on persons who fouled ditches and rivers with filtl refuse, and in 1876 Parliament passed an act intend save rivers from pollution. This act is put in force a "Boards" and "Authorities" (with how much succe Thames, the Mersey, and the Clyde will testify), seldom enforced against individuals ; and although it is easy for an individual to cease polluting a water-cours often impossible for a sanitary authority to do so i face of the apathy of the individuals by whon members of the "Board" have been elected.

Not unfrequently the "Board" is content to l individuals alone, because millions spent in sewers and millions spent in water-works is "good for trad general, and, possibly, specially good for the special tr some of the members of our Local Parliaments.

The demon of self-interest has always to be rec with when devising measures intended to benefit the Health.

Among the diseases which are caused or convey impure water are the following :—

1. Dyspepsia.	*6. Cholera.
*2. Diarrhœa.	*7. Yellow Fever.
3. Dysentery.	*8. Scarlet Fever.
4. Ague.	*9. Diphtheria.
*5. Typhoid Fever.	10. Internal Parasit

Those marked with an asterisk are certainly in cases, and probably in others, conveyed by drinking previously contaminated by human ordure.

Let us take the commonest of these diseases, ty

fever. The patient who is attacked with typhoid is attacked insidiously; he suffers from the disease, generally days, sometimes weeks, before the nature of the disease is recognised. The poisonous excreta of this patient pass into a water-course or perhaps into a cesspool (a pit in which excrement and water are commingled), and the water leaks from the cesspool into the well, and then those who drink of the well suffer in their turn from typhoid.

Typhoid poisoned water, be it remembered, may be pleasant to the eye and agreeable to the palate, and the poison is something which the chemist *cannot detect.* It is supposed that water fouled by excrements is, so to say, a soil in which typhoid (and cholera and other) poisons will readily live and probably increase and multiply; and the most that a chemist can tell us is that the water affords evidence of "previous sewage contamination," and such waters are dangerous because dangerous poisons are apt to be in them (perhaps grow in them), although they need not be always present.

It has long been suspected that the germs of the so-called zymotic diseases (of which cholera and typhoid are examples) are alive; and this suspicion has lately become a fact of which the proof is almost convincing. That the germs of these diseases will live in water is certain, because typhoid and cholera are both water-carried poisons, as has been proved any number of times. The germs of these diseases are so light that they will float in air, and their power of diffusion through water is infinite. Being alive, if a single germ only fall upon suitable ground (i.e., be swallowed by a patient apt to receive the disease) it will grow and cause the disease in its most virulent form. The germs are so small that 50,000,000 of them would barely cover a sixpence; and, theoretically, if half a pint of water swallowed by a man contain but a single germ that man is in danger of typhoid. One dejection from a typhoid patient is theoretically capable of infecting an almost unlimited volume of water. The mischief which

one case of typhoid may do is told by Professor Chaumont in "Our Homes."

"A very remarkable case was investigated a few yea ago by Dr. Thorne Thorne at Caterham and Redhill, Surr The Caterham Water Company found that they we unable to supply the whole district with their existi arrangements, and in the more remote part of the distr they were obliged to get part of their supply from neighbouring company. In the meantime they determin to enlarge their sources of supply by digging addition wells, and cutting and enlarging the adits from one to t other. Careful arrangements were made to prevent co tamination of the water during the work, and the men we instructed to carefully avoid fouling the water with an excremental matter. One of the workmen, newly tak on, was suffering, unknown to himself, from a mild attack typhoid fever, accompanied with diarrhœa, and he confess that he was obliged not only to have resort to the bucket but even to make use of the adit itself, on emergenc About twelve or fourteen days after he began to wor typhoid fever began to show itself among the consumers the water; the disease spread rapidly, and about 350 case with several deaths took place. When Dr. Thorne Thorr investigated the circumstances, one remarkable fact becam evident—viz., that the disease was almost entirely confine to that part of the district supplied with the company water pure and simple, whilst the outlying part, which wa only partially supplied from the company's wells, but whos chief supply was from those of the neighbouring compan remained nearly free from disease. This fact, joined wit the other, that the disease broke out just about the usua time after the workman must have been the cause c contaminating the well, pointed clearly to the Caterhan Company's water as the medium of contagion. Anothe corroborating fact was, that at the Lunatic Asylum, wher the water-supply was from a deep well on their own premise the inmates remained free from the disease; and at th barracks, the Guards, who also drank the water of th

Asylum well, did not suffer. The latter was a pure water, as I had an opportunity of analysing it myself. The remedial measures adopted were to stop the supply of water at once, to pump the wells dry several times, to scrape the sides of the wells and the adits and wash them with chloride of lime, and to throw large quantities of Condy's fluid into the water. From that time the disease entirely ceased. No more marked proof could be given of the transmission of the disease through water."

No more marked proof could be given of the enormous diffusion which takes place when typhoid poison is mixed with water, and of the dangers which necessarily attend upon water-carried sewage. If we foul the brooks, rivers and wells which are about our houses we must rely on water-companies for the first necessary of life, but if the common source gets poisoned we encounter epidemics of an extent unknown before.

The following case which is quoted (in German) in the sixth report of the Rivers Pollution Commissioners tells a similar tale; and it also tells us that typhoid poison cannot be removed from water by the most perfect filtration. The ensuing version of the "Lausen case" is taken, however from Mr. Noel Hartley's little book on "Water, Air and Disinfectants," published by the Society for Promoting Christian Knowledge.

In the village of Lausen, near Basle, in Switzerland, which had never within the memory of man been visited by epidemic typhoid, and in which not even a single case had occurred for many years, there broke out in August, 1882 an epidemic, which simultaneously attacked a large portion of the inhabitants. About a mile from Lausen, and separated from it by the mountainous ridge of the Stockhalden, which was probably an old moraine from the glacial epoch, lies a small parallel valley—the Fürlerthal. In an isolated farm-house, situated in this valley, a farmer, who had just returned from a long journey, was attacked by typhoid fever on June 10th. During the next two months three other cases occurred in the same house. The inhabitants

of Lausen were entirely ignorant of what had occurred this solitary mountain farm, which was cut off from communication with the rest of the world; when on seventh of August, ten of the villagers were suddenly stri down by typhoid fever, whilst during the next nine d the number of cases had already increased to 57 out o population of 780 persons living in 90 houses. In the f four weeks the number of cases reached 100 (that is to that out of every 100 persons in the village more than were attacked); and altogether, to the close of the epider at the end of October, 130 persons, or 17 in every 100 of population, were attacked, besides 14 children who w infected at Lausen during their summer holidays, a became ill after their return to school in other localit The fever cases were pretty equally distributed through the entire village, but those houses (six in number) wh were supplied with water from their own private wells a not from the public fountains were entirely exempt. T remarkable difference led to a suspicion that the pub water-supply was connected with the cause of the epiden although the apparent immaculate source of this supp seemed to negative any such suspicion.

The water came from a spring situated at the foot of t adjacent Stockhalden ridge. It was then received in a ta lined with brick-work and carefully protected from pollutic nevertheless, a careful investigation of the source of tl spring placed beyond doubt the origin of the infection.

Ten years previously it had been proved that dire water communication through the intervening mountai existed between the spring and a brook in the Fürlerth flowing past the farm-house in which the typhoid fev cases occurred. At that time (i.e. 10 years before) the was spontaneously formed, by the giving way of the s for a short distance below the farm-house and close to t brook, a hole about 8 feet deep and 3 in diameter, at t bottom of which a moderately clear stream of water w observed to be flowing. As an experiment the whole the brook water was now diverted into this hole, at t

bottom of which it entirely disappeared, but in an hour or two the spring at Lausen, at that time nearly dry from a long drought, overflowed with an abundance of water which was turbid at first, but afterwards clear, and this overflow continued until the Fürler brook was again confined to its bed. It was, however, afterwards, noticed that whenever the meadows below this hole were irrigated with the water of the Fürler brook, the volume of the Lausen water-supply became greatly augmented a few hours afterwards. Now, this irrigation, practised every year, was carried on in the summer of the epidemic from the middle to the end of July, the brook being polluted by the dejections of the typhoid patients—for it was in direct communication with the closets and dung-heaps of the infected house, whilst all the chamber slops were emptied directly into it, and the dirty linen of the patients washed in it. Soon after the irrigation had begun the water supply to Lausen which was at first turbid, acquired an unpleasant taste, and increased in volume. About three weeks after the commencement of the irrigation the sudden outbreak of typhoid fever in Lausen occurred.

In his search after the cause of this outbreak, Dr. Hägler, of Basle, did not rest satisfied with the evidence just recorded, but supplemented it by the following ingenious and conclusive experiments: The hole in the Fürler was re-opened and the brook again led into it; three hours later the fountains at Lausen delivered double the quantity of water.

"Eighteen hundred weight of salt, previously dissolved in water, was now poured into the hole, and soon the water at Lausen exhibited a great increase of saltness, until the solid matter in the water increased three-fold. The passage of the Fürlerthal water to the fountains of the fever-stricken village was thus ascertained beyond doubt. But another interesting question here presented itself; did the water find its way through the Stockhalden by a natural, open conduit, or was it filtered through the porous material of the old moraine?"

"To decide this point $2\frac{1}{2}$ tons of flour were first carefull and uniformly diffused in water, and then thrown into th hole; but neither an increase in the solid constituents nc the slightest turbidity of the Lausen water was observe after this addition."

This remarkable case shows:

1. That the power of mischief possessed by wate carried sewage is enormous.

2. That the diffusibility of typhoid poison in wate is practically infinite.

3. That water containing typhoid poison may not b purified by irrigation over water meadows and subsequer filtrations through nearly a mile of solid earth (a filter fin enough to arrest particles of wheat-flour).

4. That large typhoid epidemics are favoured by water-supply common to many people, if by mischanc that water-supply gets fouled.

Medical literature is crowded with instances of mischi caused by water being contaminated by leakage fror sewers and cesspools. The fact is so well established tha it is not necessary to weary the reader with instance The above cases show clearly, (1) that one man ha infected 350 others; and (2), that infections may trav for a mile through an underground filter.

In the face of the Lausen case it would almost seem tha the absolute protection of a water supply is nearly impossibl Deep wells which are sunk in chalk or any other porou soil are liable to pollution from foulness finding its wa into them through cracks or fissures in the soil, and thi danger is proportionate to the amount of water pumpe from the well.

Professor de Chaumont ("Our Homes," p. 787) says "The area of surface drained by wells is a question c some difficulty. It has been stated as a circle, the radiu of which is the depth of the well; but this appears to be grave understatement of the case, if we look to the evidenc which has been obtained from the effects of pumping upo distant wells, or the way in which wells have sometime

been drained by outflows of water at distant lower levels. A well in a gravel and sandy soil in South Hampshire was found to be drained dry in consequence of an outflow of water in a gravel pit dug a considerable distance off. The difference of level between the higher point (that is the bottom of the well) and the lower (the outflow at the gravel pit) was 21½ feet, the distance between the two 1720 feet; so that the area drained had a radius equal to 80 times the depth, here represented by the fall or difference in level between the two points."

Messrs. Rogers Field and Wallace Peggs have, in the same work, given us the following instructive information.

"Deep wells are much less liable to contamination than shallow wells, but even they are not safe from the insidious influence of cesspools. A very striking instance of this occurred at Liverpool some years ago in the case of the Dudlow Lane well, sunk in the new red sandstone formation. This well was situated in a suburban district some distance from Liverpool, and was 247 feet deep with a bore hole at the bottom, another 196 feet deep, making 443 feet altogether. The effect of the continuous pumping from this well was to dry the wells of the houses in the neighbourhood, and these were then used in several cases by the householders as cesspools. The consequence was that the water in the Dudlow Lane well was gradually polluted, and in five years after the well was constructed it had to be disused.

The following is the official report of the Water Committee on the matter:—

"In the case of the Dudlow Lane well the committee were compelled to cease pumping from February 1872 to 5th May 1873, in consequence of the dangerous extent to which the water was contaminated. It was ascertained that the evil was mainly due to percolation from cesspools and disused wells which had been receptacles for drainage; and the Committee caused the communication with several of these to be temporarily diverted, at the same time pressing the local authorities, and co-operating with them,

to carry out a complete sewerage scheme for the distric By these means the quality of the water was so far improve that it was brought within the limits defined by the Rive Pollution Commission as "reasonably safe," and the pum ing was resumed."

Now, we are told that the danger of contamination c deep wells is not due merely to their depth but still mo to the depression of the level of the water which is cause by the pumping. When the demand for water is great an the pumping is severe the flow of water from the so around the well into the well itself is considerable, as th distance to which the influence of the pumping extend depends so much on the depression of the water due to th pumping; it is convenient to express this distance in term of the depression, or, in other words, to say that the distanc the well draws is 20 times the depression, 30 times th depression, and so on. This distance is most importa from a sanitary point of view, determining, as it does, nc only whether one well will influence another, but wheth or not a well will be polluted by a cesspool or other sourc of contamination in the neighbourhood, and we wi therefore give a few examples of the distance under differe circumstances.

Locality.	Authority.	Nature of Strata.	Depression of water in well.	Extreme distance to which influence of pumping extends.	Ratio of distance to depression.
			ft. in.	ft.	
Nuremberg (1)	Thiem . .	Fine sand . . .	1 4	33	24
,, (2)	,,	,,	2 2	33	15
Dresden . .	Salbach .	Fine gravel . . .	8 2	108	22
Leipsig . .	Thiem .	Very coarse gravel .	6 7	1050	160
Gravesend. .	Clutterbuck	Chalk	10 6	600	57
Liverpool . .	Deacon .	New Red Sandstone	82	11,710	143

From the above table it will be seen "that the distanc to which the influence of pumping extends varies greatly i

different cases, being in one case only fifteen times the depression, and in another as much as 160 times the depression. The chief circumstance which seems to influence the distance is the degree of permeability of the strata through which the water has to percolate. In fine sand and fine gravel where there is a large amount of resistance to the passage of the water; the distance varies from 15 to 39 times the depression. In the chalk, where fissures exist which facilitate the passage of water, the distance is 57 times the depression."

Thus it appears that even the deepest wells may be fouled by cesspools, and if by cesspools, equally by leaking drains or sewers. And since we cannot know when a cesspool or a deeply buried sewer begins to leak, it is impossible to feel quite secure with regard to water supply from deep wells in the chalk, which is, just now, the most popular source for water, and is being largely recommended. The danger of contamination from a distance is (in the case of chalk and other porous soils) proportioned to the depth of the well, and is also proportionate in some degree to the demand made upon the well for water; so that a public well may not prove dangerous until population has increased around it and the demands made upon the well have proportionately increased.

Let us look at the possibilities of a typhoid epidemic from the pollution of a public well. At Lausen we saw that 19 per cent of those who drank the polluted water suffered from typhoid, and if the same proportion be maintained in other instances, then we might reasonably expect in the case of typhoid poison finding its way into a public well, that 19 would suffer out of every 100 persons dependent upon that well for their water—190 persons in a population of 1000; 1900 persons in a population of 10,000; or 19,000 persons in a population of 100,000. Of those attacked 5 per cent. at least would die.

Water companies throughout the country ought to be made liable to an action for damages in the case of their water being turned to poison. The most vigilant super-

vision must be maintained in order to prevent contamin tion; and frequent analysis should always be made compu sory, and should be done by independent analysts at t expense of the company.

It is, we have seen, an easy matter to foul rivers, wate courses and wells. How can water be purified when on fouled? *Filtering* only removes coarse floating impuriti and most certainly is not to be relied upon for the remov of typhoid poison. When a filter has been too long in u it may dirty the water instead of cleaning it.

Boiling will probably destroy typhoid and similar poison but boiling for a short time only is, there is some reason believe, not absolutely reliable.

Evaporation and re-condensation is a sure method purification. This is being done for us constantly by t sun, which evaporates the water which falls upon the ear raises it in clouds, and gives it back to us again as ra Beneficent Nature is constantly engaged in purifying t water.

If we wish to have a constant supply of pure water ne at hand we must religiously abstain from careless wa pollution. Prevention is better than cure, and it is easier to stop water pollution than to remedy it.

In rural and semi-rural places water should never be u for carrying excrement; and building should be so contr that water-carried excrement may not become neces Water used for domestic purposes should be throw the nearest available piece of ground. Some will be evaporated, some will be absorbed together with r organic matter by the roots of growing plants; and the will filter slowly through the earth and find its way to a w course in a state of practical purity (certainly not in a po ous condition, if no excrement have been mixed with it

During the summer months, while vegetation is vigo and the temperature high, scarcely any of the water soak far away, but all will be evaporated and absorbe the roots of the plants. Trees and vegetables, be it obse are the best and really the only effectual scaven

They suck the water from the soil and keep it dry. It has been estimated by Pettenkofer, that an oak tree with 711,592 leaves will, during the summer, evaporate 8⅓ times the amount of which falls on the ground which it covers. The Eucalyptus Globulus will evaporate 11 times the rainfall. In winter less would be evaporated and more would soak away, but when the temperature of the air is low the death rate from cholera or typhoid is low also; and it is probable that a low temperature is not favourable for the growth of the organisms which carry these poisons. We should always expose waste water to the air or to alternations of temperature; the heat or the east wind will dry it up and stop the growth of organisms; cold will freeze it, and equally stop the growth of organisms. In sewers and cesspools there is neither heat nor cold, summer nor winter. In that muggy damp atmosphere evaporation and oxygenation are impossible. And waste water, after travelling miles of pipes is not appreciably diminished in volume, and is charged in addition with whatever of impurity it may have met with in its dark journey.

From what has been said it will be gathered that cesspools ought not, *under any circumstances*, to be permitted. If they be mere holes dug in a porous soil, their contents may soak nobody knows where. If they be impermeable they are still hot-beds of filth-disease, which affect those in the neighbourhood.

There is all the difference imaginable between a cesspool and an old-fashioned privy. The latter was more or less open, but little liquid found its way into it, and evaporation rendered the contents so solid that soakage and leakage were, if not impossible, at least difficult of occurrence.

A cesspool receives water, and its contents *must* soak away, diffusing poison through the earth. The constant pouring of liquid slops into the same hole day by day is sure to cause cracks and fissures in the soil, and the pressure of water is sure to force an outlet often where least suspected.

Cesspools must be written down as the most immoral all insanitary subterfuges, and their construction should absolutely disallowed. Excrement should never be allow to come into contact with water. Open channels are bet than closed pipes for the escape of waste water fr houses.

Closed sewers should only be resorted to in cases of direst necessity and with a full sense of their danger. A solid excrements (which are often dangerous poiso should be kept out of them lest the diffusions of excrem poison become co-extensive with the sewer.

Under existing conditions surface wells are not s sources for water. A well of moderate depth, protect from surface drainage and in the middle of a well-cultiva plot of ground, would be a safe source for water if no ce pools existed. Surface wells in towns, the soil of which excrement sodden, are little better than cesspools, and th are highly dangerous. The most dangerous surface w of all are probably those in big towns like London, wh owing to the gas in the earth and the sulphur in the air, vegetation is possible. The water which soaked throu the earth to the celebrated Broad Street Pump, wh claimed so many victims during the Cholera Epidemic 1854, had no chance of giving up its organic matters to roots of plants all greedy to receive it, because in that f soil and with the foul atmosphere of Broad Street no pla would grow. The water of this pump contained over grains of solid matter in each gallon, and was charged the products of organic refuse.

As we have seen, no method of purifying fouled w short of evaporation does anything but remove the c impurities. Domestic filtration is useless, and filtratio public bodies is equally useless in ridding water of or poisons. The schemes which are so general throu the country for precipitating and filtering sewage succeed only in making the water less objectionable t senses. They often add to the amount of *dissolved m* in the water, and certainly leave the organic poison

touched. All this is recognised and stated by the Rivers Pollution Commissioners in their sixth report made to Parliament in 1874, and yet we find the sanitary authorities of this country countenancing and even encouraging such schemes (notably in the Thames Valley), well knowing that after the expenditure of millions of capital and a large annual outlay the Thames water will be even less fit for drinking purposes than it was before. While these schemes are countenanced, be it observed, there is no attempt to make individuals do their duty.

The idea seems very general that it is impossible to supply too much water for the daily use of households. This is very questionable. Enough is as good as a feast. No very large amount of water is needed for the attainment of absolute cleanliness, both personal and domestic. The man who is minded to be clean will attain his end with a very small amount of water; and even though we take a river to those who love dirt, they will make no use of it.

It is certainly not advisable to dirty more water than is necessary, because by law, the water must be purified again before it returns to the river, and this entails endless expense on sanitary authorities.

If those who rely on public bodies for their water supply are made to pay for exactly as much as they use, we may be sure that no excessive waste will take place, and there is but little fear that the price will be such as to prevent even the poorest from having enough.

The objection which is raised to the supplying of water by meter is, that under such circumstances, the poor would be insufficiently supplied. It would be easy, however, to adopt a sliding scale of charges, giving the water of necessity at a low rate and charging more for the water of luxury. If sixpence per thousand gallons were charged for the first 10 gallons per head per diem, this would amount to 1*s.* 9*d.* per head per annum. A shilling per thousand might be charged for the next 5 gallons per head per diem, and 1*s.* 6*d.* for the next 5 gallons, and so on.

CHAPTER III.

AIR.

WE all know the importance of fresh air. Our instincts have told us this from all time. Now-a-days every child is taught in the Board Schools the scientific proofs of why we need fresh air, so that any lengthy disquisition of this point will not be necessary.

We breathe some sixteen times in a minute, and we take in nearly a pint of air at each breath, or two gallons every minute, or 120 gallons every hour, or 2880 gallons every twenty-four hours. Each pint of *fresh* air contains about 15·8 ounces of nitrogen, with 4·19 ounces of oxygen, and to this is added ·008 ounce of carbonic acid. We use up the oxygen and we give off carbonic acid, so that every pint of expired breath contains still 15·8 ounces of nitrogen, with 3·26 ounces of oxygen, and 0·94 ounce of carbonic acid. Expired air contains in addition much watery vapour together with organic matters, which w recognise in "the smell of humanity," which is alwa present in a crowded room, or a closed bedroom w has been slept in.

Air which has been breathed once is poisonous, ar man in an hermetically sealed room would soon die.

The constant admission of fresh air to rooms absolute necessity, and were it not for chimneys, ill- doors and windows, keyholes, chinks and crannies walls, and the accidental opening and shutting of suffocation would be a far more common mode c than it is.

In order that the air of an apartment may wholesome, our breath needs constant dilution air; and if we are to keep the amount of carb anywhere near its normal point, it is obvious t

100 pints of fresh air must be admitted for each breath which is drawn by every person in the room, or about 12,000 gallons per head per hour.

For every person in an apartment, there ought to be an air-hole having the diameter of a gallon measure, and through this the air should move, with a velocity equal to 12,000 times the height of a gallon measure, or about 7,000 feet per hour, or about 120 feet per minute, or 2 feet per second. For every inlet there must be an outlet of equal size. If the apartment be small and the air-inlet in a bad position, draughts will be created, because the large proportion borne by the incoming air to the total air in the apartment will cause currents to be felt everywhere. If the apartment be big and the inlet be 6½ or 7 feet from the ground and deliver its air vertically, and if (in cold weather) the incoming air be warmed, no draught will be caused.

As regards outlets, the ordinary open fireplace is usually sufficient. It is not advisable to give less than 1000 cubic feet of space to each occupant of a room. In prisons, each cell contains about 800 cubic feet of space, and, says Professor de Chaumont, "practically this is found to be too small."

Each gas-flame or lamp uses up the air just as a human being does, so that in calculating the amount of cubic space necessary, we must reckon each lamp or gas-burner as an individual. It must be remembered that great cubic space is of no use unless inlets for fresh and outlets for foul air be also provided.

Ordinary churches are as a rule very badly ventilated. The cubic space is enormous, but its quantity is due entirely to height. The area in proportion to the congregation is very small indeed, and the 700 or 800 people in an ordinary church almost touch each other. In addition to the people there are often a great many gas-burners. There is often no ventilation, and it is a growing custom to replace the plain window, which might be opened, but seldom was, by a painted window which cannot be opened even if desired. What is the consequence of all this? The

people give off their 120 gallons per head per hour of hot foul breath; this ascends towards the roof of the nave, and being cooled, sinks (for carbonic acid is heavy) and envelopes the congregation, as it were, with a soporific pall. Some faint, others go to sleep, and the preacher, poor man! perhaps fancies that the sermon and not the carbonic acid is the narcotic which has acted on his flock.

If any aspirant for clerical honours wishes to gain a reputation as a forcible and enlivening preacher, let him first ventilate his church, and let him be sure, whenever he puts up a stained window which will not open, to compensate for the loss by putting in a ventilator in some other place.

Let him also remember that one of the liveliest and most successful preachers that ever adorned our Church, honest Hugh Latimer, gained his reputation while preaching in *the open air* at Paul's Cross. In like manner the theatres which so successfully spurred the intellects of the greatest poets of the world (the Greek Dramatists and Shakespeare), were freely exposed to the fresh air, and poet and actor alike had the advantage of audiences in which the critical faculty was neither blunted nor savaged by th atmospheric foulness of the place.

We live in an age of public meetings, and throughout th country there are hundreds or perhaps thousands of gath ings every day for the purpose of discussing questi of public interest. How few of these meeting-rooms adequately ventilated; and how much harm is don sitting for hours and breathing your neighbour's b almost undiluted, it would be difficult to say! It is tole certain that "colds" are caught by sitting in foul r If air is deficient in oxygen and is loaded with vapours, the elimination of refuse matter from the does not go on properly, and when we have reduc bodies to a state to be affected by any untoward stance we suddenly chill the surface by opening a or going into the cold night air, and then we b latter circumstance only, and give little attentic

two or three hours' preparation for mischief which we had previously undergone.

The *open air* even in the most crowded London streets is always infinitely more pure than the air of even well-ventilated rooms. The reason for this is that the volume of our atmosphere is, as compared with the volume of foul air which escapes from our houses, almost infinite, and the dilution which foul air undergoes is infinite.

The foul air is lost as soon as it escapes from our houses. It is diffused, mixed and blown away. Air moves at the average rate of 10 miles per hour, 17,600 yards, or 52,800 feet. Taking the area occupied by a man at 9 square feet, we find that the astonishing quantity of 475,200 cubic feet, or 2,980,000 gallons of air per hour rush over the surface of the body of a man exposed to the fresh air. It must be remembered also that in streets and narrow channels the rate at which the air travels is often greater than in open places, and that in times of storm and wind the rate at which the air travels may be four or six times the average. Thus we see that the air which blows over one man in the open is enough to meet the respiratory needs of 1000. If we take the average London street, 50 feet wide and flanked by houses 50 feet high, the area of the cross-section of such a street would be 2500 square feet, and the amount of air passing through each part of such a street per hour would amount to an average of 132,000,000 cubic feet, or 825,000,000 gallons, or more than enough for 68,000 men. Thus we see that the purifying action of the air is, by its enormous volume and diluting power, practically infinite. The amount of fouling of the atmosphere by the whole animal life of the world is but as the most microscopic drop in the bucket. We now see why it is that infection rarely travels for any distance through the open air. Well-established cases of infection being blown from house to house (in the absence of any subterranean communication by sewers, community of water supply or personal intercourse by laundresses, tradesmen or others) are, as far as I know, non-existent, although we must admit their possi-

bility. This is explained by the above facts, as well as by the further fact that most organic poisons are quickly oxidised and destroyed by the oxygen and ozone in the air.

A consideration of the above facts throws no little doubt upon the teaching of some of our hospital architects who insist upon the necessity of separating the various pavilions containing the sick by enormous interspaces. As long as the air admitted to a sick-room comes really *from the outside* that air will be practically pure, and it will make no appreciable difference whether the next pavilion is 50 or 1000 feet away. We must be sure, however, that the air employed for ventilation is really outside air, and that it has not been used before in kitchens, or more noisome places, and is not merely allowed to drift from one part of a building to another, whether by staircases, corridors, lifts or shoots.

The air which has been fouled by the respiration of men and animals; by the combustion of gas, oils and fuel, and by the exhalations from filth, is not only being constantly diluted but it is constantly being purified. What we give off, plants need; what plants give off, we need. Th carbonic acid which escapes from our breath is absorbed b the green leaves of plants, which convert the carbon int starch and allied bodies, and give back a great part of t oxygen in a pure state. During night, it is true, plants g off carbonic acid, but it is equally true that at night respiratory needs of men and animals are at a minim The influence of light, therefore, by stimulating the elir tion of oxygen by green leaves, has great power ove condition of the atmosphere. Analyses of air show there is less carbonic acid in the neighbourhood of lux vegetation than where vegetation is absent. This dif is not great, because of the very free movement atmosphere, but it is quite enough to be measural close courts of cities the carbonic acid is notably in and in crowded places, such as school-rooms and the amount is dangerously great.

There are certain poisons which seem to travel mainly through the air. These are influenza, measles, whooping-cough, small-pox, typhus fever, mumps, and chicken-pox. Typhoid fever and cholera may also travel through the air, and there is good reason to suppose that that commonest of common diseases, consumption or phthisis, if not communicable through the air, is at least more dependent upon the constant breathing of foul air than any other one condition. We have seen that contagion in the open air is so diffused that it is more likely than not to be harmless even supposing that it be not destroyed. In dwellings the risk of contagion through the air is very great, and a case of measles or whooping-cough, even though it be confined to one room in a house, is very likely to infect any other children who may be in the house. In overcrowded and ill-ventilated rooms, contagious particles which are given off have but little chance of escape, and are very likely to be inhaled by somebody else. Crowded gatherings of children must be reckoned among the great causes of the dissemination of many of the diseases of childhood. The risks of contagion through the air are diminished in proportion to the thoroughness of the ventilation.

It is an undeniable fact also that consumption of the lungs has been in many places greatly diminished by proper ventilation and also by proper drainage, thereby causing greater healthiness and dryness of the dwelling, and getting rid of a sewage-sodden soil.

There can be no doubt that our moral responsibilities with regard to the air we breathe are very great. Our first duty is not to foul the air more than we can help, to keep all about us clean and pure, and not to allow heaps of evil-smelling refuse to collect about our dwellings.

Our next duty is to see that a proper supply of fresh air is admitted to our dwellings. If this be done there will be a higher standard of health in the dwelling, more food will be needed, more work will be done. Of the economy of giving an ample supply of fresh air there can be no doubt. Employers of labour should remember this, and especially

those who employ young people. All work-rooms should have ample cubic space and free admission of air. The master will then have more work, and more cheerfully performed, than otherwise would be the case.

Take care that every gas-light is provided with a flue communicating with the outside air. There is no real difficulty in accomplishing this; and if it be done, not only will the gas-light not *foul* the air, but it will aid in the ventilation of the room just as the fire does, by creating a draught up its little chimney.

In school-rooms and other places where mental work is to be done, good ventilation is of the greatest importance, and has a very great influence on the quality of the work done.

We must all of us try to set a good example in this matter of cubic space and ventilation. When, for example, we wish to show hospitality to our friends we must remember not to stint the supply of the prime necessary of life. The average London dining-room is perhaps 20 feet by 16 feet by 12, and contains, inclusive of the space occupied by furniture, &c., less than 4000 cubic feet, or space considered sufficient for 5 convicts in H. M. prison at Pentonville. If we wish to do honour to our guests we invite sometimes as many as eighteen, and to wait upon them we employ four servants, and we light the room with half a dozen lamps or their equivalent, i.e. we put into our 4000 cubic feet of space the equivalent of twenty-eight people, and we give them 143 cubic feet of space each, and as we provide no adequate inlet or outlet for fresh air, it i not to be wondered at that the discomfort often reach agony point, and that the conversation lags; nor is it matter of surprise that the average London dinner, whe you are suffocated and over-fed, is reckoned among t duties rather than the pleasures of existence, and that malaise of the following day is (often wrongly) attrib to the quality of the wine.

The "at home," where 150 persons (not reckonin lights) crowd into about 8000 cubic feet of space, with

thing like 50 cubic feet of space each, is, as is demonstrated by arithmetic, as nearly as possible three times as bad as the dinner. Perhaps the day will dawn when it will be considered "bad form" to give your guests not more than one-twentieth of the cubic space, and far less than one-twentieth of the fresh air, which is allotted to criminals.

Again, will nobody set us an example of keeping good hours? "Early to bed and early to rise," says the old proverb, "makes a man healthy and wealthy and wise." If we keep what are known as "bad" hours (i.e., the hours kept by the House of Commons), we are perforce obliged to spend those hours in rooms artificially lighted and warmed, and instead of breathing fresh air we breathe foul. The evils arising from this need not be dwelt upon. Such a state of existence is hardly compatible with good health. The M. P. at the end of the session, and the young lady at the end of the season, are standing examples of this fact. During the summer there are about fifteen hours of day-light and nine of darkness. It is the fashion to rise about seven hours after sunrise, and to retire about seven hours after sunset, and the masses follow the leaders of fashion. Will anybody calculate the unnecessary waste of gas and other illuminants caused by our obstinate refusal to make use of the sun-light? How many cubic feet of carbonic acid and sulphur compounds are poured into the London air in consequence of this perversity? How much unnecessary smoke is poured into it from the same cause? What advantage, if any, is got by converting night into day?

We have dwelt mainly upon the pollution of the air by respiration and organic refuse. The pollution by inorganic matter is, in large cities, scarcely less important. The London atmosphere is the dirtiest in the world. The skin and linen of the Londoner are grimy in a few hours after cleansing. As a consequence the Londoner is always washing and he makes a boast of his enforced cleanliness, instead of being ashamed of the grimy cause of it. It is always well to make a virtue of necessity.

The London air is loaded with soot from chimneys, and with carbonic acid and sulphur compounds, the result of the combustion of coal and gas. In dry weather also it reeks of ammonia given off from the streets unwashed by rain and covered with horse-droppings. Only a very few plants will live in London, and none of them can be said to flourish. There is not a rose and scarcely a fir-tree of any kind in the metropolis. The leaves of plants are choked by soot, and they are killed by the acid in the air.

This state of things has grown with the growth of the city. At present there are probably few ladies strong enough to walk from Charing Cross in a straight line into the real country in any direction.

If the wind were to drop to a dead calm for a week many of the dwellers in the centre of London would certainly be killed or seriously affected by the overcharged atmosphere. When cold and calm coincide we get fog and darkness. In December 1873 the death rate in the central districts rose from 19 to 43 per 1000 from this cause alone, and deaths from diseases of the respiratory organs were 551 above the average. At this time it was found necessary to remove 36 out of every 100 animals exhibited at the Smithfield show, and of those removed many had to be killed. They were victims to fog.

We have not improved since then, and in spite of a' our efforts, the smoke will remain proportionate to th number of houses.

There can be little doubt that the domestic fireplace the main cause of the trouble, and therefore it becomes moral duty of the householder to burn as few coals as poss in order to diminish the smoke. The better the comb tion of the coals, the greater the heat given off; less is consumed, and less smoke escapes up the chim It is cheap and comfortable to diminish the smoke o fires, another added to the many instances already giv the thriftiness of good sanitary morals.

Grates of fire-clay with solid bottoms are a

improvement on the old-fashioned grates, and save quite a fourth of the coal. Here is comfort and hope.

It is difficult, however, to get even small improvements effected in houses held on short lease, and especially when improvements are "compensated" for by increased rents. Our comfort dwindles and our hopes are dashed.

CHAPTER IV.

THE RIGHT USE OF REFUSE.

IT may be as well to warn the reader that there is a good deal of unsavoury matter in the present chapter, but as it is undoubtedly the moral duty of every individual to try to come to some conclusions as to the proper use to be made of the refuse matter which necessarily accumulates around him in the act of living, I hope that those who have read thus far will peruse this chapter also, because I believe it to be the most important of all.

"Refuse" is defined as that which is refused or rejected as useless. The refuse of a household consists of—

1. Those parts of our food which we do not attempt to eat, such as parings of potatoes and other vegetables, the entrails of birds and small animals used for food, &c.
2. The portions of food left *after* cooking, such as bones and other indigestible portions.
3. Dust resulting from the wear and tear of furniture, clothing, and the contents of the house generally, together with matter brought or blown in from the outside.
4. The incombustible residue of fuel.
5. "Litter," such as old papers, boxes, and clothing.
6. The water which has been used for cooking a cleansing purposes, i.e., "house-slops."
7. Solid excreta.
8. Liquid excreta (urine).

The early nomad races of mankind were not troub' their refuse. When they moved camp the refuse w upon the ground ; and birds and animals, the mother the freshening showers, the free air and the sun-ligt turned all refuse matter to account ; and the d'

deserted camping ground shone in the lapse of time like a green islet in the landscape with an abundant and vigorous herbage. Were it not for refuse matter there would be no difficulty in living in communities; and the chief, if not the sole, duty of the sanitarian is to guide us in the right use of refuse. If every individual in the country made a right use of refuse, we should know nothing of Rivers Pollution Commissioners, Sewage Commissioners, water companies, local boards or sanitary laws; and the amount which would be saved in useless expenditure, and the amount which we should gain in increased health and increased crops, is simply incalculable.

A poet would say that the goddess Hygeia should be represented as attended by two handmaidens, "Cleanliness" and "Thrift." The housewife who is most thrifty will have the least refuse to deal with, and she who is most cleanly will seek to quickly put her refuse to its right use.

Dirt, it has been said, is merely "matter in the wrong place," and in the eyes of the moral sanitarian dirt is non-existent. Nature moves in a circle. The earth brings forth "grass, the herb yielding seed, and the fruit-tree yielding fruit." These form the food of animals and of man, and the excreta of animals and of man become in their turn the food of plants. The organic excreta of animals are decomposed and absorbed by the roots of plants, and the carbonic acid in the breath is absorbed by the leaves, and the green leaves in their turn give out oxygen which is so necessary for the support of animal life. Thus animal and plant life are complementary and mutually dependent on each other. Neither can exist without the other.

If we bear in mind this law of Nature, against which there is no appeal, and which is as inexorable as it is beneficent, we shall have no difficulty in dealing with refuse. If we depart from Nature's law we shall meet with endless difficulty, and we shall merely impose upon ourselves the task which was imposed on Sisyphus in the lower world. Sisyphus, according to the Grecian fable, was condemned to roll a huge marble block up a high hill, and as soon as the

block had reached the summit it rolled back again, and the hapless Sisyphus had to commence his task once more.

The Sisyphi of the present day are very strong. They are corporate. They have the aid of millions of money, of cunning engineers, of steam machines. The stone is rolled often to a prodigious height, the crowd applauds the exhibition of so much strength and such marvellous ingenuity. The stone has never yet been balanced on the summit of the hill, and prodigious and unremitting labour is required to delay the rolling back of the huge block with a thundering crash into the valley, and with a disaster-bearing impulse proportioned to the height to which it has been raised.

The lower animals are of service in the thrifty use of refuse, and those who have a plot of ground attached to their houses find that a pig and some poultry will eat much of the food which man is too dainty to consume, and reduce it to a state more fitted to become the food of plants. It is found that in the downward march of organic matter towards the inorganic the lower animals are of great service, and flies, beetles, worms, water-fleas and much smaller fry (of which more anon), are all to be looked upon as essential to the welding of the perfect circle in which Nature moves. Even the fish in our rivers will consume a certain amount of refuse and thrive upon it, but that amount is strictly limited. Poultry especially require a little animal food, anc if that which man cannot eat be boiled for the use of th fowls they will lay more eggs than when their diet consis solely of corn.

That food refuse of this kind has a value is shown from fact that it finds a ready market in great towns ; and *p vided it is collected with sufficient frequency*, it may be to hucksters, but if it cannot be quickly got rid of, th best thing to do with all organic refuse is to bury it *it.* If thrown upon the dust-heap it will putrefy anc disease.

It need hardly be said that a good cook will from bones every particle of matter fit for food b

counts them as refuse. Bones (especially if broken) are invaluable in the garden, and in towns they are readily bought for manurial purposes.

Dust should not be encouraged to accumulate. Dust is largely composed of organic matter, the dead bodies of insects, the eggs of insects, scales, &c. from the human body, and the germs of disease. Do not have fluffy hangings which hold the dust, nor thick pile carpets, nor useless ledges, nor dark unreachable corners. Have your rooms so that they can be easily dusted; dust them often and *throw the dust on the fire.*

The best housewife will have the least residue from her fires. If grates be good and fuel be good, cinder sifters are almost unnecessary, because (especially in a solid bottomed grate lined with fire-clay) the fuel will burn really to ash, i.e., to a white or red powder as the case may be. The more perfect the combustion of your fuel, the less fuel will be burnt, the less the air will be fouled by smoke, the less will be the quantity of refuse fuel to be got rid of, and the greater will be the manurial value of the resulting ash. Ashes should be thrown on the garden day by day. An ash-heap close to a house is an abomination and should not be tolerated. In towns the ashes and dust ought to be collected *day by day.* In a big house, well managed, the ashes and dust ought not to be bulky, and if the inhabitants assisted in their collection by being ready when the dust-cart makes its rounds, the dustman's duty ought to be performed nearly as quickly as the postman's. The dust collection in London is a scandal, and there can be no doubt that the habit of allowing dust to accumulate in "bins," which are most difficult of access to the dustman, causes great delay in collecting. It is the moral duty of the individual to assist the public authorities in collecting dust and to quicken the process and do away with the necessity of accumulations.

Litter should not be allowed to accumulate. Waste papers of all kinds are readily marketable, and should be got rid of because they harbour dust and impurity.

Old clothing and rags should be got rid of as quickly as

possible for similar reasons, and because they harbour moth as well as dust. Those who are not very poor should never wear "cast-off clothing," unless it has been thoroughly disinfected. It is better to be clothed neatly in clean new garments than to wear cast-off finery, which often looks ridiculous and always harbours filth.

As regards house-slops, it should be borne in mind that the best and most thrifty cooks have the least residue from their cooking, and that it is not always those householders who use the most water that are the cleanliest in their persons or who have the purest houses.

The right use of house-slops and of solid and liquid excreta, which are in a high degree putrescible, is a large question, and one that has been much debated. In order, therefore, to discuss the question profitably, we must consider some points which are essential to its proper comprehension.

It is only within the last few years that the influence of microscopic organisms in the cycle of changes which is perpetually going on around us has been demonstrated. Before the invention of the microscope any knowledge of particles of matter too small to be visible to the naked eye was impossible. Our knowledge of the invisible has kept pace with the successive improvements which have been made in the microscope, and to-day the attention of microscopists is largely engaged with objects so minute that without the use of the micrometer they would be inconceivable to our minds. The powers of the microscope are, it must be remembered, strictly limited, and it may b[e] probably is, a fact that the best microscopes now ma[y] only enable us to see, as it were, the mere fringe of *infinitely little*, just as the astronomer's telescope gives but a glimpse of the beginning of the *infinitely great*.

The part which minute organisms play can be appreciated if we take a familiar example; and a few on the every-day process, known as *fermentation*, will the reader to understand certain other processes wh equally or less familiar.

Fermentation as commonly known is that change which takes place in grape-juice, weak solutions of sugar, or the "sweet wort" of the brewer, whereby alcohol is formed, and wine or beer is manufactured as the case may be. The brewer makes an infusion of malt, and when this has cooled to a suitable temperature, he adds to it some "yeast." The liquid soon becomes turbid, bubbles of gas (carbonic acid) rise to the surface, and the yeast grows and multiplies to four or five fold of the amount originally used. Cagniard de la Tour in France and Schwann in Germany were the first to discover that yeast was a fungus-like plant, and it remained for Pasteur to show in what way the plant (called *Torula* or *Saccharomyces Cerevisiæ*) in growing operated upon the fluid into which it was put. This important question of fermentation is dealt with, lucidly and eloquently, by Professor Tyndall in his work on 'Floating Matter of the Air,' and many of the facts I am about to give have been culled from that interesting volume. "Consider," says Tyndall, "the beer in its barrel with a single small aperture open to the air through which it is observed not to imbibe oxygen but to pour forth carbonic acid. Whence come the volumes of oxygen necessary to the production of this latter gas? The small quantity of atmospheric air dissolved in the wort and overlying it would be totally incompetent to supply the necessary oxygen. In no other way can the yeast plant obtain the gas necessary for its respiration than by wrenching it from surrounding substances in which oxygen exists, not free but in a state of combination. It decomposes the sugar of the solution in which it grows, produces heat, breathes forth carbonic acid and one of the liquid products of the decomposition is our familiar alcohol. The act of fermentation, then, is a result of the effort of the little plant to maintain its respiration by means of *combined* oxygen when its supply of free oxygen is cut off. As defined by Pasteur, fermentation is *life without air*."

If the yeast plant be sown in a fermentable liquid and

with a *free supply of air*, the plant will grow and carbonic acid will be given off, but very little, if any, alcohol will be formed, because the plant can live independently of the combined oxygen which is in the liquid.

There are certain points in connection with this process which ought to be indelibly fixed upon the mind.

1. The yeast plant grows and multiplies.

2. The plant grows only in liquids having a certain composition and a certain strength.

3. It grows luxuriantly only at certain temperatures.

4. It grows luxuriantly in the dark (in which it differs from plants having green leaves).

5. It gives off carbonic acid, and does not, like the green plants, give off oxygen.

6. If it fails to obtain oxygen from the air, it takes it from the fluid in which it grows, and in so doing changes the composition of the fluid and gives rise to a body which, when taken internally, has a physiological effect different from that of the original liquid.

7. "A little leaven leavens the whole lump." This could not occur if the yeast plant were not alive. The plant which has been cultivated in one liquid can be propagated in a second by the process of transplantation, and so on *ad infinitum*.

8. Chemically vinous fermentation consists in the conversion of grape-sugar into carbonic acid and alcohol ; and the fact for us to notice is that in the process a body of a certain complexity of composition is resolved into two bodies, each simpler in composition. It assists in the *decomposition* c grape-sugar, and one of the bodies generated (carbonic aci is readily consumed as food by green-leaved plants.

Now, vinous fermentation has been taken as the type a process which is as essential for our well-being as i common.

Putrefaction is now recognised as a form of fermenta The bubbling, stinking, frothy mass which is seen i cesspool, the sewer, and not unfrequently in our ri largely composed of organic matter undergoing a p tive fermentation.

It is now generally recognised that wherever fermentation or putrefaction occurs, it takes place by the aid of minute organisms, and it has been proved by many first-rate observers (Pasteur, Tyndall, Lister, and others) that if the minute organisms can be excluded from the fermentable or putrescible liquid, fermentation or putrefaction will not take place.

The motes of the sunbeam are to a great extent living organisms, and if they chance to fall on ground suited for their cultivation they increase and multiply and set up fermentative or putrefactive changes.

These living motes are all but omnipresent. They vary in number in different localities. They are few on Alpine heights, more numerous on the lower plains, most numerous of all in cities, and especially in the dirtiest and most crowded quarters of them.

The putrefaction of putrescible matter is very difficult to prevent, and its prevention can only be accomplished by the observance of the greatest care. Chemists and physicists nave succeeded in killing the germs which may be present in any putrescible liquid, and in filtering out all germs from the air admitted to those liquids. This having been done —the liquid and the air having been both sterilized, as it is called—the liquids will remain unchanged for months or years, but directly ordinary germ-laden air is admitted to them, or if the liquids be inoculated with the smallest drop of germ-laden liquid, fermentation or putrefaction will pursue its ordinary course. It would take too long to give the processes by which sterilization is effected, but the fact is now so universally recognised that any long digression seems unnecessary, and I must ask the reader to believe that what I have just stated are facts which do not admit of any reasonable doubt.

Among the crowd of motes which are seen dancing in the sunbeam are microscopic portions of the yeast plant ready to grow in the first fermentable liquid with which they come in contact. Thus it comes about that fermentation is, so to speak, a spontaneous change, and it is well known that grape-juice and sweet wort will both ferment even though

no yeast be added to them. The fermentation of grape-juice is always accomplished "spontaneously" and without the addition of yeast, because the necessary ferment grows as a parasite on the ripe grape and the stalks of the vine.

If the brewer were to leave his fermentation to chance, however, the fermentation would be slow and unsatisfactory —slow, because the quantity of yeast which would fall into the vat from the air would be too small to produce a satisfactory and luxuriant growth of the plant, and unsatisfactory because organisms of a nature different to the yeast would fall in also and produce fermentations of a different kind.

Weeds would, as it were, choke the yeast plant which it is sought to cultivate, and the beer would be spoiled. When the yeast plant is put in quantity into the wort its growth is vigorous, and the accidental weed-germs go, as it were, to the wall. By cultivation weeds are kept under. This is as true of the saccharomyces as it is of cabbages.

Beer is very often spoiled, and wine also, by being accidentally inoculated with noxious organisms. When vinous fermentation is sought, acid fermentations or bitter fermentations or putrid or viscous fermentations may come unasked, and these untoward occurrences are now known to be due to the accidental inoculation of the beer with minute organisms other than the saccharomyces. These organisms are many of them very small and rod-shaped, and are technically known as Bacteria. The mischief which is done to beer by the accidental presence of bacteria is sc well known that now-a-days in the best breweries no samp' of yeast is ever used which has not been first subjected tr searching microscopical examination. Thus it will be se that beer and wine are liable to diseases, and that th diseases, being due to inoculation with noxious germs, preventible if due care be taken. The Burton brewer loses many thousand pounds if his fermentations b diseased, has learnt the money value of preventive m as applied to wort.

The bacteria which are apt to infest breweries live at a temperature in which the yeast plant will

and hence the custom of fermenting at very low temperatures has become common, especially in Germany. The yeast plant does not grow so quickly at a low temperature, and hence the fermentation at low temperatures though slow is sure.

These low organisms (bacteria), which are so troublesome to the brewer, are, says Tyndall, "by no means purely useless or purely mischievous in the economy of nature. They are only noxious when out of their proper place. They exercise a useful and valuable function as the burners and consumers of dead matter, animal and vegetable, reducing such matter with a rapidity otherwise unattainable, to innocent carbonic acid and water. Furthermore, they are not all alike, and it is only restricted classes of them that are really dangerous to man. One difference in their habits is worthy of special reference here. Air, or rather the oxygen of the air, which is absolutely necessary to the support of the bacteria of putrefaction, is, according to Pasteur, absolutely deadly to the vibrios which provoke butyric acid fermentation."

These organisms which are so active in producing fermentation and putrefaction are killed by certain processes. For example, the extremes of heat and cold and the absence of moisture will arrest their growth and kill them; and they are unable to exist in the presence of certain bodies which are known as "antiseptics." Chief among these are corrosive sublimate, arsenic, iodoform, carbolic acid, quinine, certain volatile aromatic vegetable products, such as menthol, thymol, eucalyphol, &c., permanganate of potash and alcohol.

It will be seen from what precedes that bacteria and other lowly organisms play a most important part in the economy of nature, that their action, in their proper sphere, is beneficent in the highest degree, and that we could not possibly get on without them.

Just as, however, there be plants which are used for food and others which are poisonous; as there is a difference between the *Agaricus campestris*, the common mushroom of our tables, and the *Agaricus muscarius*, the fatal fly fungus,

so there are some low organisms which are benignant and others which are malignant in their action. Further, as these organisms belong to the infinitely little it is not easy to distinguish them by the eye. If the careless observer can mistake the root of aconite for that of horseradish, the sweet for the bitter almond, or the *Œnanthe crocata* for the celery, need we be surprised if it is hard to learn the distinguishing features of bodies which are less than $\frac{1}{10000}$ of an inch in diameter, or if bodies so minute, and which are apparently alike, really differ in their properties as much as the sweet and bitter almond differ?

That dangerous bacteria and other microscopic organisms really exist is now beyond all reasonable doubt. It is owing mainly to the researches of Koch that the detection of these minute organisms has been rendered possible. They are spoken of as *Bacilli*, *Bacteria*, *Micrococci*, &c., and their presence is found to be almost universal. They have been found in connection with ague and malarious fevers, splenic fever of cattle, relapsing fever, blood poisoning of hospitals, small-pox, and vaccine disease, leprosy, erysipelas, and phthisis. It is asserted by some observers that they have been detected in connection with cholera, typhoid fever, diphtheria, yellow fever, and acute pneumonia; but with regard to these latter the case cannot be considered to be settled. The proof that some of the diseases named are in some way or another directly connected with the growth of organisms seems unanswerable. The organisms have beer *seen* not by one but by many observers. They have bee separated and *cultivated* in specially prepared fluids, whic are known as *cultivating liquids*. The cultivated organis of one liquid has been transplanted to a second cultivat liquid, and the organism from this to a third, and so on, the remote lineal descendant of the original organisr been inserted into the blood of an animal with the res producing in the animal the disease in connection with the original parent organism was found. Such a pr this seems conclusive. With regard to malarious splenic fever of cattle (malignant pustule or wo

disease in man), erysipelas, pyæmia (hospital blood-poisoning), phthisis, the disease of silk-worms, and chicken cholera (the two last investigated by Pasteur), the evidence which has been offered of their connection with minute organisms seems unanswerable. The investigation is very difficult, and the difficulty is increased because the diseases of men and animals are not always interchangeable. One animal may take a disease readily, but another animal nearly allied to the first may prove incapable of inoculation. Thus, with regard to one form of blood-poisoning occurring in mice, it has been shown that one species of mouse is certainly killed by the inoculation, while another species closely allied is unharmed by a similar procedure. It is a well-known fact that men are not equally susceptible to zymotic disease. If a body of men be exposed to the same source of poison it is rarely that *all* of them suffer. Some die, some are acutely ill and recover, some are slightly ill, and some escape scot free. The state of health of the man, the condition of the soil, as it were, is probably the cause of this. A perfectly healthy man will resist the action of the poison (if the dose be not excessive). The unhealthy man, the man whose blood is loaded with effete matter or diseased from insufficient and improper food will probably succumb. The cause of the frightful mortality of the epidemics of the Middle Ages was probably due to their operating upon populations neglectful of all the rules of health and in a state bordering on scurvy from insufficient and improper diet. That fever follows in the wake of famine is well known and universally acknowledged. It is lucky for us that these malignant organisms are difficult to grow. They are probably numerous enough ; but the conditions necessary for their cultivation are, in respect of many of them, fortunately rare.

Now bacteria will not live in pure water, because pure water does not contain the food which is necessary for them. The bacteria do not grow any more than plants will grow if placed in a soil incapable of affording nourishment. In order that bacteria may grow in water the water

must contain an organic carbonaceous matter, nitrogenous matter, and a small quantity of phosphate. "Pasteur's fluid," which he uses largely for the cultivation of bacteria, is composed of a clear and weak solution of sugar, ammonium tartrate and the burnt ash of yeast. If a drop of ordinary water be added to a quantity of Pasteur's fluid the latter will soon become cloudy from the growth of organisms; and the rapidity and density of the cloudiness is in some degree a test of the degree to which inoculation has taken place—a test, that is, of the purity of the added water. The presence of living organisms in water shows that the water contains food for these organisms, i.e. organic matter both carbonaceous and nitrogenous, and in the vast majority of cases this organic matter has come from decomposing organic matter whether animal or vegetable. Various fluids have been used as "cultivating liquids" for minute organisms. Blood, urine; infusions of tea, hay, turnip; and broths made of gelatine, fish, flesh, and fowl.

"Cultivating liquids!" Man has only to provide the liquid and nature is certain to provide the seed and the subsequent growth of organisms.

Any effete organic matter is food for the bacteria of putrefaction and probably for many other kinds of bacteria also. Kill the germs by means of antiseptics or heat, or exclude the air by hermetically sealing, and putrefaction will not take place. Hams "cured" by salt (a powerful antiseptic), bottled fruits and tinned meats are illustratior of this fact which we meet with every day.

Knowing the conditions which favour the growth bacteria it is tolerably easy to prevent these conditic If we suffer organisms to grow it is not so easy to kill tł Prevention is better than cure.

Let us take an example. Two centuries ago there no more common diseases in this country than agu dysentery. In many parts of the world agu dysentery are still common, but in the British I should have almost forgotten their existence but occasional importation of cases from our tropica'

The poison of ague is bred in marshes, and it has long been recognised that the three factors necessary for its growth are warmth, moisture and decaying organic matter. Klebs and Crudeli assert that the actual poison is an organism which they call *Bacillus malariæ*, and they have detected this organism in the lower strata of the air of the Roman marshes, and in the waters flowing therefrom as well as in the blood of ague patients. They have cultivated this bacillus in soils artificially prepared ; they have inoculated dogs with the artificially cultivated bacillus ; the dogs have suffered from all the symptoms of ague, and in the enlarged spleens of these animals there was found after death a large number of bacilli.

We not only know the conditions under which the ague poison grows, but we know also how to kill it. Quinine is the antiseptic which has been used to cure ague for many years ; and it is now shown that quinine probably acts by killing the bacillus which is the cause of the disease.

It is good to give quinine when a man has ague ; but how much better is it to prevent him from having the ague, and save him from suffering, loss of health, anxiety and expense.

The prevention of ague is effected by the cultivation and the drainage of the marshes. The quick growing blue gum tree of Australia, the *Eucalyptus globulus*, has a great reputation for antimalarial properties. It sucks up the water from the marsh, and thereby drains it, and it is possible also that the antiseptic qualities of the gum which the tree affords are potent in destroying the ague poison. Failing the blue gum tree, however, any form of cultivation seems able to destroy malaria, and if in place of moisture and decaying organic matter we can have a luxuriant vegetation and adequate drainage of the soil, we need no longer fear to traverse the plain, which, now a garden, was once feared as a most dangerous plague spot.

Let us take another example. Pyæmia, or blood-poisoning, has been till quite recently the scourge of hospitals, and many a hospital from this cause has proved a curse rather than a blessing to those who were taken to it. "Hospitalism," as it was called, has an extensive literature,

and every plan was tried to get rid of the scourge which decimated surgical patients. The pulling down of badly constructed buildings, and their re-erection on improved plans was resorted to, and with some success, but ere long "Pyæmia" appeared in the new as it had done in the old hospitals. When I was a student, a surgical ward was known by its smell, and what surgeons often spoke of as "laudable pus," was anything but praiseworthy in the faint sickly odour which it emitted. It has remained for Sir Joseph Lister to point out the true cause of pyæmia, which was to be found in the putrefaction of the discharges from wounds, and the re-absorption of the products of putrefaction into the blood of the patient. Lister was struck by Pasteur's experiments and by the proof afforded by that *savant* that putrefaction was due to inoculation of putrescible matter by germs floating in the air. Now, living tissues are not putrescible, but the effete discharges from wounds are eminently so, and Lister was the first to show that the putrefaction from wounds might be prevented by (1) not allowing the discharges to accumulate, and (2) by using antiseptics to prevent the commencement of thos changes which too often resulted in the death of th patient. Pyæmia was common, and when it occurred wa rarely recovered from. Now happily it is getting m rare every year. Pyæmia was not amenable to medi treatment, but, the way being pointed out, its preventior comparatively easy.

With regard to ague and pyæmia, it has been sho that directly the cultivation spot of the poison was rec nized it was possible to prevent that cultivation, a practically to stamp out the disease. Where the mala poison or the pyæmic poison first came from, we kn no more than we know whence came the first cabb seed or the spore of the first mushroom; but if there anything in the doctrine of the "survival of the fittest," if we cease to afford conditions favourable for the culti tion of these poisons, why should they not become exti like the megatherium and the dodo, and some of plants of the coal measures?

The reader will be asking, "What has all this to do with the responsibility of the individual in relation to health?" Let us see. I have frequently used the expression "cultivation" in relation to these bodies, and have shown that organisms both benignant and malignant have been grown and propagated in cultivating liquids. These liquids may be composed of carefully devised mixtures of salts, or of infusions of animal or vegetable matter. Any putrescible liquid will serve as a cultivating medium, and the cultivation is favoured by warmth. Some organisms grow best with a limited supply of oxygen, some are killed by oxygen, some take their oxygen indifferently from the air or the liquid in which they grow, the result on the liquid differing in the two cases. The effect of light on the growth of these low organisms is not accurately known. Most of them grow independently of light, and it is possible that the growth of some of them is favoured by darkness.

It is tolerably certain that milk serves as a cultivating liquid for the poison of typhoid fever. The number of typhoid epidemics which have occurred, owing to the mixing with the milk of water previously contaminated with the excreta of a typhoid patient, makes it highly probable that milk not only keeps the poison alive, but actually helps in its growth and multiplication.

It seems highly probable also that sewage water serves as a cultivating liquid for the poison of typhoid and the poison possibly of cholera. Sewage water composed of cooking water, house-slops, and urine with solid excreta suspended in it, would seem to be a most perfect "cultivating liquid," and the warm moist atmosphere of the sewer or cesspool (together with the darkness possibly) would seem to furnish conditions the most favourable that can be imagined for the growth of organisms. It is probable also that the water of foul surface-wells containing a large quantity of organic matter serves, if not to cultivate, to keep alive the poison of typhoid and cholera.

All putrescible matter may serve as a cultivating spot for the germs of putrefaction or disease.

The amount of typhoid, cholera, and other forms of sickness (such as sore throat and diphtheria), which have been laid to the charge of sewers, cesspools, and foul surface-wells, together with our increasing knowledge of the growth of organisms in "cultivating liquids," must "give us pause," and make us consider whether it is wise to keep large quantities of putrescible organic liquids near our houses when such a course can possibly be prevented. At least it seems very undesirable to allow solid excreta to find their way, under any circumstances, into cesspools or sewers It may be argued that well-made sewers allow of no accumulations, but such an argument is not justifiable, because from what we know of the growth of fungi and low organisms they grow largely at the high-water mark at places which at one time are covered and then are left for a time uncovered by water. I find in Parkes's 'Practical Hygiene,' p. 373, the following paragraph which forcibly illustrates this point:—"Even in so-called self-cleansing sewers, it has been noticed by Mr. Rawlinson that the changing level of the water in the sewers leaves a deposit on the sides, which, being alternately wet and dry, soon putrefies. In foul sewers a quantity of slimy matter collects on the crown of the sewers; it is sometimes two to four inches in thickness, and is highly offensive. When obtained from a Liverpool sewer by Dr. Parkes and Dr. Burdon-Sanderson, it was found alkaline from ammonia and containing nitrates. On microscopic examination, this Liverpool sewer-slime contained an immense amount of fungoid growth, and *bacteria* as well as some *confervæ*. There were also acari and remains of other animals and ova."

Truly a sewer is an unlovely thing to think upon, with its stench, gases and fungi, bred of putrefying liquids seething in the dark and out of reach of the purifying influence of sunlight and fresh air. Every one who is unfortunately compelled to live in crowded places where the evil of sewers has to be endured, in order to ward off greater evils, ought to bear a wary eye lest the poison-bearing air of the sewer gain access to his dwelling and rob his household of health,

the greatest of all treasures. Even if we disregard the organisms and the organic matter which is present in the air of cesspools and sewers, it will be found that from a chemical point of view such air is highly undesirable. Many a man has been killed by incautiously descending an old dead well or cesspool, from the amount in it of carbonic acid, i.e. of the gas which extinguishes equally the flame of a candle and the flame of life. The following analysis of fresh air and cesspool air will prove instructive.

	Fresh Air.	Cesspool Air (Lévy).
Nitrogen	79·00	94·00
Oxygen	20·96	2·00
Carbonic acid	00·04	4·00
	100·00	100·00

Sewer air varies very much in composition according to the degree of flushing and ventilation, but carbonic acid, even in the best sewers, is always in great excess, varying from 0·106 to 3·400 per cent, i.e. from nearly three times to more than eighty times the proper quantity in air used for breathing. The carbonic acid is probably largely due to the fungi and low organisms which grow in cesspools and sewers, and the fact that fungi compete with us for the oxygen of the air, and foul the air with carbonic acid, makes the presence of even the most benignant of them at all times undesirable in and around our houses.

Common experience tells us that a habitation in which dank moulds and fungi gain a footing is unhealthy, and it is only the incompetent housewife who permits their growth. Nevertheless, we have most of us a fungus conservatory connected with our dwellings by a pipe, but being out of sight it is too often out of mind.

The great use of putrefaction in the economy of nature is that it decomposes organic matter into its simpler elements, changes the organic into the inorganic, and renders effete vegetable and animal matters fit to once more become the food of plants. The value of organisms in this process is that the change goes on independently

of the atmosphere, or nearly so. Notwithstanding tha putrefaction in its proper place is useful to us, we hav seen how harmful it may be in close proximity to ou dwellings, and how the putrefying mass may harbou organisms which are in the highest degree poisonous.

Now the remains and refuse of animals and vegetable may be partially reduced to the state of plant-foo without the occurrence of offensive putrefaction, by process which is largely chemical and consists to a grea extent of oxidation. Dr. Angus Smith has shown (an gives the details in an admirable report presented to th Local Government Board in 1882) that thorough aeratio of fresh sewage suffices to oxidise it to a certain sligl extent; that by thorough aeration the putrefaction sewage may be delayed, and that after putrefaction h carried the decomposition of sewage to a certain exte the admixture of it with fresh air and fresh water w quickly complete the decomposition which it is sought bring about.

Oxidation, however, without the aid of putrefaction h very little effect in purifying sewage, and the Rive Pollution Commissioners (sixth Report, 1874) came to t following conclusions on the subject:—

"1. When the sewage of towns or other polluting orga matter is discharged into running water, the suspend matter may be more or less perfectly removed by subsider and filtration, but the foul organic matters in solution very persistent. They oxidise very slowly, and they removed only to a slight extent by sand filtration. Th is no river in the United Kingdom long enough to sec the oxidation and destruction of any sewage which may discharged into it even at its source."

"2. Of all the processes which have been proposed the purification of sewage, or of water polluted by ex mentitious matters, there is not one which is sufficien effective to warrant the use, for dietetic purposes, of wat which has been so contaminated. In our opinio therefore, rivers which have received sewage, even if th

sewage has been purified before its discharge, are not safe sources of potable water" (p. 427).

There is evidence, however, that the free admission of air influences the growth of malignant organisms. Some interesting experiments by Dr. Alexander Ogston on the organisms which cause "blood-poisoning" in the surgical wards of hospitals, shows that these organisms are best cultivated in the absence of air, and Dr. Ogston succeeded in growing these organisms most easily when the inoculating fluid was injected by means of a fine grooved needle into an egg. Some experiments made by Pasteur on the cultivation of the organism which causes chicken cholera, seem to prove conclusively that the growth of the organism is checked, and its virulence weakened in proportion to the amount of air admitted to it.

There is only one way of getting rid of sewage without annoyance and without danger, and that is to apply it to its right use, viz. *feed plants with it.* Dr. Angus Smith examined the effluent water from sewage works of different kinds, and embodied his results in a letter addressed to the Local Government Board in 1879. The effluent waters examined were the result of five different processes, viz.—

1. Sewage from irrigation (Aldershot).
2. Precipitation with alum and iron and subsequent irrigation (Coventry).
3. Precipitation by lime (Birmingham).
4. " " " (Burnley).
5. " alum and clay, ABC process (Aylesbury).

The results at Aldershot differed somewhat according to the weather. In judging of the value of these processes Dr. Angus Smith was at pains to estimate the degree to which the ammonia (the pungent gas which accompanies putrefaction) had been removed from the original sewage, and the following were his results:—

					Per cent.	
The	Aldershot process (in dry weather)			removed	98·9	of ammonia.
"	Coventry "	..	..	"	93·6	"
"	Aylesbury "	..	..	"	82·4	"
"	Burnley "	..	..	"	34·9	"
"	Birmingham "	..	..	"	15·2	"

Judged by this test the irrigation processes are far ahead of the others.

When nitrogenous matter is exposed to the influence of air it is oxidised, and nitric acid is formed, and Dr. Smith accordingly estimated the amount of nitric acid in 100,000 parts of effluent water in order to test the degree to which oxidation had taken place. The following were the results:—Aldershot, in dry weather, 9·23 parts of nitric acid in 100,000; Aylesbury, 3·19; Birmingham, 2·13; Coventry, 1·22; and Burnley, 1·20. Dr. Smith's tables show that the best method of treating sewage is to feed plants with it.

Irrigation acts by

1. Arresting solid matter.
2. Oxidation.
3. Chemical interchanges between the sewage, the soil, and the rootlets of the plants.

The oxidation is largely brought about by the oxygen of the air, which is greedily absorbed by the earth, and which is brought to the soil in rain water.

Rain water contains over 2 per cent. by bulk of gases dissolved in it, and these gases are composed of—

	Per cent.
Nitrogen	1·308
Oxygen	·637
Carbonic acid	·128
	2·073

The gases found in water from deep chalk wells are very different in amount, and are thus composed—

	Per cent.
Nitrogen	1·944
Oxygen	·028
Carbonic acid	5·520

Thus it will be seen that rain water contains dissolved in it more than twenty-two times the amount of oxygen which is found in deep well water, and is, therefore, far more able to bring about the oxidation of sewage matter in the soil, and make it fit food for plants. Rain water is preferred by gardeners for the watering of plants.

Water which has been used for cooking has had all the gas boiled out of it, and therefore the cooking water, urine, and hard water (which is often used for household purposes), and which, mixed, constitute slops, are not calculated to assist oxidation, especially in places where air cannot gain access.

Putrefaction is favoured by moisture. In old days it was the custom to merely drop solid excrement into a covered pit. No water, except urine, had access to it, and it was no great annoyance. It formed a mass almost solid, the odour was *sui generis*, but not very offensive, and the danger of soakage into wells was slight in proportion to the solidity and dryness of the mass. There was a pit of this kind at New College, Oxford, which had been made by William of Wykeham, and was emptied for the first time a few years since. No evil was ever traced to this privy-pit. When the custom obtained of keeping solid excrement in a pit, and of allowing slop water to trickle in another direction through open channels to the nearest water-course, the sanitary condition thus brought about was by no means bad.

When the water-closet was invented and water-carried sewage came into fashion, and when solid and fluid excrements and house-slops were all shot together into a cesspool to putrefy, the conditions were changed. Horrible and poisonous stenches arose from these cesspools, and their contents leaked through into neighbouring wells. In this way the machinery was laid for the production of local outbreaks of typhoid fever. The annoyance which arose from cesspools after the invention of the water-closet was so great that, especially in large towns such as London, it became necessary to divert excremental matters and slops into the public sewers, which up to that time had been used for surface drainage only. Thus, in London between 1830 and 1855 the houses drained into the Thames close to those parts of the river whence the water-supply was derived. Thus the machinery was perfected for epidemics of typhoid and cholera on a large scale. This condition of

things prevailed, as I have said, from 1830 to 1855, and it is not a little remarkable that in 1832 a disease appeared in this country which, if it had been previously imported, had not hitherto attracted public attention by its extent. This was the Asiatic cholera, which committed frightful ravages in the Metropolis and elsewhere in 1832, 1847–8, and 1854. The epidemic of 1854 was terrible, and so obviously connected with the contamination of the water-supply by sewage, that those water companies which hitherto had taken their water from the tideway of the Thames were compelled by Act of Parliament to draw their supplies from above Teddington Lock. Quantities of water-carried sewage finds its way now into the Thames between Hampton and Teddington, close to the intake of the water companies, but as we have removed our cholera and typhoid factory a dozen miles outside the city, we have ceased to think of it, and we shall probably sleep tranquilly till we are rudely awakened by facts.

As regards typhoid fever it is certainly remarkable tha it was not thoroughly recognised in this country until th close of the fourth decade of the present century. Th symptoms of the disease are so characteristic and th anatomical changes are so well marked, that it is remarkab it should have escaped detection, unless it were that up t within a short time of its establishment as a separa disease it was of rare occurrence and rarely epidemic.

Typhoid is essentially a sewage poison, and is due eith to the contamination of drinking water or milk with typho excrement, or to the inhalation of typhoid poison wi sewer air.

It is incontestable that most of the deaths from typho are directly or indirectly attributable to water-carried sewage, to cesspools leaking into surface-wells, to sewer pipes leaking into water-pipes, to sewage running into streams used for water-supply, and to the regurgitation into our houses of air from sewers owing to defective "sanitary arrangements." It is incontestable also that a the time when typhoid was "discovered" in this countr

(1849) the machinery for its production was, so to say, perfect. It is difficult to say who discovered it. More than one physician in this country and in France were on the scent, and it is more easy to believe that these men saw the disease, because it was present in quantity sufficient to stand out clearly, rather than to believe that the great men who preceded them were deficient in observation.

I am strongly of opinion that the discovery of typhoid and the frightful cholera epidemics to which I have alluded were due to the introduction of "water-carried sewage," at a time when we only saw its advantages, and before we learned its dangers.

Cholera and typhoid are universally acknowledged to be sewage poisons. The poison in both cases is given off from the bowels of the patient and escapes with his excreta into the sewer or cesspool, thence it soaks into the drinking water, and those who drink the infected water suffer in their turn. Typhoid is generally due to drinking typhoid-poisoned water, or milk adulterated with typhoid-poisoned water. Although this is the usual mode of conveyance of the poison, it is incontestable that the germs may also be carried through the atmosphere, and this fact seems to favour the view that cholera poison and typhoid poison are not merely disseminated through the water into which they fall, but actually grow and ripen in it, and perhaps produce spores which, like the spores of the fungus of the potato disease, are under favourable circumstances wafted through the air. This theory receives some support from the fact that when the infection of typhoid is carried through the air, what is known as the incubitive period is longer than when the infection is water-carried. Diseases, the poison of which is not furnished by the bowels, are not so likely to be carried by sewage into water. The poison of scarlet fever and small-pox emanates mainly from the breath and skin; that of diphtheria mainly from the throat. The clothing of scarlet fever and small-pox patients will carry the contagion, and the membrane from the throat of a diphtheria patient is poisonous, and it is certain that linen

fouled by the matter coughed up by a diphtheria patient would be poisonous. Clothing and handkerchiefs are, however, put into the wash-tub and boiled, and are not put down the sewer under ordinary circumstances, so that the conveyance of these poisons by sewage is not to be expected, at least as a frequent occurrence. It is certain, however, that scarlet fever may be conveyed by milk just as typhoid is, and there is some evidence that diphtheria may be conveyed in the same way. It is probably true, therefore, that the poisons of these two diseases will live in organic fluids, and it has often been suspected, though hardly proved, that both these diseases have been produced by sewer air. The urine of scarlet fever and diphtheria patients is probably poisonous, and this may find its way into the sewer, and in the sewer the germs may be kep alive and even grow. If the poison of scarlet fever an diphtheria were given off by the bowels (of which there is n evidence), they might pass into the category of commo sewer diseases. If the germs will live in milk, they woul probably live also in sewage, and the fact that thes poisons in the ordinary course of events travel to the wash tub, and not to the sewer, may be regarded as a mos fortunate circumstance.

I have been obliged to enter rather fully into questior which may prove a little difficult of comprehension to thos who are unacquainted with scientific phrases, but it manifestly impossible to show "the right use of refuse without being at some pains to show why certain metho are wrong.

The lessons to be learnt from the preceding long di cussion seem to be these:

1. Keep solid and liquid refuse always separate.

2. Apply both to the land before putrefaction sets in.

3. A cesspool is always dangerous to yourself and neighbours.

4. A pit for the reception of *solids only* is far less dangerous than a cesspool.

5. It is better to let slop-water run in an open channe

than a closed pipe, because the former is more easily cleaned, and the slops are exposed to the air, drying winds, heat and frost.

The immediate filtration of house-slops, so as to free slop-water from the coarser inpurities, is easy, and may be effected (provided the discharge pipes are 18 inches from the ground) through a flower-pot half full of cinders, or any other simple contrivance, and the filter may be changed as often as is necessary.

It is wasteful to throw away slop-water if you have a garden or conservatory in which it may be used.

If you have a big garden then collect your slops in a tank on wheels and apply them to a different piece of ground every day.

Or you may have a special slop-filter made and provided with good drainage beneath, and filled up with porous earth, to be changed at intervals. A filter of this kind, as big as an ordinary two-light pit or hot-bed, would filter fifty gallons of slops per diem with ease.

A living filter is the best of all: and the surest way of making slops innocuous is to apply them to well-drained land in cultivation, and it must be borne in mind that slop-water alone is much better than mixed sewage for irrigation purposes. The cleaner the fluid the better, because the earth does not get clogged. Immense crops of rye grass, roots and succulent vegetables may be obtained in this way.

When sewage irrigation is conducted on a large scale by municipal authorities one acre of land is allowed to every hundred inhabitants, and it is estimated that each acre will take two thousand gallons of sewage every twenty-four hours. Thus it is calculated that there is twenty gallons of sewage per inhabitant to be dealt with, inclusive of water used for street cleaning and municipal purposes. Domestic slops (where water-closets are not used) average not more than ten gallons per head; so that a very small piece of land would be sufficient to take the slops of a household which used the earth or other dry methods of treating solid

excrement. If an acre will take two thousand gallons of mixed sewage, it would probably take three thousand gallons of slops only. An acre consists of rather more than 43,000 square feet, so that 430 square feet would be wanted for 30 gallons, and (say) 150 square feet for 10 gallons, and 1500 square feet for a household of ten persons, or a piece of ground 50 feet by 30; so that the possessor of a quarter of an acre of garden need (theoretically) only use $\frac{1}{7}$ part of it in order to render the slops of ten persons fit to be returned to the natural water-courses.

I have gone into this calculation in order to show what are the bare possibilities of dealing with sewage. A slop-garden, a slop-plot, a slop-conservatory, a slop-hotbed, o[r] even a slop-flower-pot are each of them more manageabl[e] than a sewage farm.

I cannot conceive how any householder who is th[e] possessor of ever so small a plot of ground can calmly con[-] template cesspools or sewers when the dry-earth system i[s] so much more cleanly, cheap, and healthy.

It is perfectly evident from what I have said that th[e] owner of a very small garden may be quite independent [of] sewers and cesspools, and he will have the satisfaction [of] knowing that no filth, from his house at least, is tricklin[g] to a water source or poisoning the air, and he will have th[e] satisfaction of having his health in his own keeping instea[d] of handing it over to tradesmen whose work is out of sigh[t]. He will have the satisfaction of feeling also that he h[as] done his duty to himself, his neighbours, and the soil.

It may, I think, in relation to this question of sewage, [be] laid down as an axiom that—*the greater the detail t[he] greater the ease, the greater the security to health, and t[he] greater the profit.*

This was fully appreciated by Moses (the greatest sanitarian that ever lived), as those who can call to mind the 12th and 13th verses of the 23rd chapter of the book of Deuteronomy will remember.

The great leader and lawgiver of the Jews made it incum-bent on the individual to take care that his refuse matte[r]

should not become a source of danger or annoyance to his neighbour or the community, and I am strongly impressed with the fact that in the present day the individual is forgetful of his duty, and that he is too often encouraged to forget it by public authorities.

The valley of the Thames is now in great difficulty about its sewage. The valley of the Thames is to a great extent a region of villas and market-gardens, and there are thousands of houses that ought not to be dependent upon any public authority to remove their filth. The individual is unwilling to do his duty, and the authorities are unwilling to compel him. Instead of making the villa-resident deal with his own filth as he might do, instead of compelling the jerry-builder to bear the expense of cleansing his unwholesome houses, as he ought to be made to do, it is sought to remedy the evil by a great sewage scheme, and good citizens will be heavily taxed to cleanse the filthy property of bad citizens, and the end will be that, although there may be less obvious matter in the Thames, it will, as a matter of fact, be more poisonous for drinking purposes than before. And when the sewer has been made the jerry-builder will rejoice. Market-gardens will grow cottages instead of cauliflowers, and little houses will be packed side by side, and perhaps back to back, and lovely spots where the Londoner has sought health and relaxation will become as crowded as Marylebone. There is no doubt that one of the evils consequent on sewerage schemes is overcrowding. As long as it is considered that the connection of a house with a sewer is the be-all and end-all of sanitation, and that sufficient curtilage is of no consequence, it may be safely assumed that the speculative builder will not fail to seize his opportunity. These great schemes involve an enormous initial outlay and a huge annual expense, and they press very unfairly on the inhabitants. For the owner of a villa who may have a laudable desire to use and purify his own refuse matter is more heavily taxed than he who is absolutely dependent on the public authorities for the removal of filth from his residence. Those who

cultivate a sense of moral duty ought to be encouraged, and those who have no sanitary morals should be discouraged, but in practice the course which is taken is too often exactly the reverse.

Railways have already done much for the destruction of the market-gardens of the Thames valley, and a great sewage scheme will do the rest. Hitherto the manure from the stables of the London mews has been utilized to a great extent in these gardens, with the result that the former have been marvellously clean and healthy, and the latter marvellously productive. With the disappearance of the Thames valley gardens those who keep horses will have to face difficulties and expenses to which hitherto they have been strangers, and the cleansing of the London mews will become more difficult.

I have said with regard to sewage disposal that "the greater the detail, the greatet the ease." This is obvious. A man with a small garden should have no difficulty in dealing with his refuse, and it is his moral duty to do so. Again, even where there is no garden the solid excreta should not be put down the sewer. Arrangements ought to be made for its decent removal in a dry state, and no house ought to be built unless some such arrangement is provided for. The only methods of sewage disposal which have returned any profit to municipalities are the so-called dry methods. Glasgow, Manchester, Warrington, Carlsrule, Mannheim, and other places of less importance, testify to this fact; and if it can be done in great cities where the refuse has to be taken long distances before it is utilized, how much more readily can it be done in country and suburban places where it can be utilized almost on the spot?

Directly solid refuse is diluted with water its money value vanishes, although its theoretical manurial value remains, which is not the same thing. A ton of quartz may contain gold of the value of a sovereign, but it is obvious that the ton of quartz is not worth a sovereign, especially if it have to be transported to a distance before the gold is

extracted. Under such circumstances it is very possible that the extraction of the sovereign's worth of gold may cost thirty shillings. This is why all schemes for dealing profitably with sewage water have failed financially. With dry methods it is different.

When solid matter is washed into a sewer by the help of five gallons of water, the manurial value of the matter is enormously diminished, and five gallons of water have been unnecessarily dirtied and will have to be cleansed again before they can take their natural course to the nearest stream.

The great advantage which is claimed for water-carried sewage is that by its means the dwelling is readily rid of disagreeable stuff. It is all very well to pull a handle and shoot poisonous matter into the river where your neighbour bathes or drinks, but the morality of the act is more than questionable. It seems to me very like throwing dead dogs or other things which cause you annoyance over your neighbour's wall. Water-carriage is, I believe, the most dangerous, the most expensive, and the most immoral of all methods of dealing with sewage. London began it in [illegible], it caused trouble with the cesspools, then trouble with the sewers, then trouble with the Thames. Having got so far into trouble, and having found it, from the fouling of the river, a burden too grievous to be borne, there was no attempt to do what other big cities have done, but a water-carriage on an enormous scale was promulgated, and six millions were spent in carrying London sewage to Barking. This was done some twenty years ago, and we have now over 2000 miles of sewers beneath the London streets. The report of the Commissioners, just issued, tells us that as a consequence the fish are dead between Greenwich and Greenhithe, and that in dry weather the sewage floats back to us and as high as Teddington Lock. It is evident that so far from being at the end of our difficulties, that they have increased rather than diminished, and that before long the whole question will have to be considered again.

It is true that the scheme has improved the condition of matters close to London, but this improvement cannot in the nature of things be permanent, and with our rapidly increasing population, and the consequent enormous increase of sewage, it is difficult to see the end.

If after the great fire of 1666 it had been recognised that the only way of dealing with sewage is to put it on the soil, how different would our position have been now.

To go with nature is easy and economical, to fight against her is expensive and dangerous, and must end in failure, for nature's laws are not to be repealed by Acts of Parliament or local bye-laws.

The frightful waste involved in our present system in London is worth considering. Messrs. Lawes and Gilbert (and there are no higher authorities) estimate that the potential value of the London sewage amounts to £1,273,000 annually. This pearl of great price being diluted with about 60,000,000,000 gallons of water its actual value is of course very different from its potential value, but it is undeniable that if dry methods and irrigation for slops could be introduced into London, much of the value of the sewage would be realized; the Thames would be cleared, and we should cease to scatter and disseminate disease germs in the most perfect and thorough manner which ever entered into the mind of man to conceive. The Londoner is not a thrifty being as a rule. Steam machinery has killed the thrift in him. His butter (made from refuse fat) comes by a circuitous route from Holland, and is known in the trade as "Bosch;" much of his "milk" is brought in tins from Switzerland; France supplies most of his eggs; America sends him pork, corn and tinned foods innumerable. Fresh vegetables come from the south of Europe; fruit from every quarter of the globe; and new potatoes from Scilly and the Channel Islands are to be had in London almost before the home-grown ones have pushed their green tops through the soil. The air of his own district is so foul that nothing will grow; manure is of no use to him, and the legend that fine peaches

were once grown in Gower Street is so strange as scarcely to be credible. Free Trade has enabled the Londoner to live, but it certainly has not cultivated in him thrifty habits of thought. It seems tolerably clear that the only thing to save London from gradually drifting into an utterly unmanageable hypertrophy is to adopt strict rules as to building operations. No house built in the future, on a new site, ought to be allowed to send its solid sewage matter to the Thames, and every house ought to have a curtilage, in proportion to its size, at least sufficient for the decent and ready removal of filth. If the owner of an estate wishes to lay it out for building purposes, he ought to satisfy the authorities that he has arranged for the decent disposal of the filth, and it is only reasonable that the expense of such removal should fall upon the owner of the soil who takes the ground-rents, and not upon the public at large, who have no share in his profits.

Until the individual occupier and the individual owner of property is made to feel his moral responsibilities, and, if necessary, is compelled to do his duty towards his neighbours, there can be no permanent improvement in the condition of great cities, and rural and semi-rural districts will drift into the same dangerously over-crowded state which characterises our big towns, and in the size of which we seem to take an unaccountable pride, as though their overgrown dimensions were an undoubted advantage to the public at large.

CHAPTER V.

BURIAL.

"All go unto one place; all are of the dust, and all turn to dust again."—Eccles. iii. 20.

THE question of burial is one that has occupied, and rightly occupied, the public mind. It behoves each one of us to have a clear idea upon the physiological process of death, which, equally with birth, all must undergo, and it may reasonably be hoped that fear of it will lessen with the advance of education.

A dead body, like other forms of organic refuse, becomes a prey to lower forms of life, and ultimately serves as food for plants. If we try to stop or hinder a natural process, the dead body becomes a nuisance and a danger. Nature's laws cannot be revoked. They are eternal. She laughs, as it were, at lead coffins, sarcophagi, brick vaults, or Egyptian pyramids. She can bide her time, "for a thousand years" in her sight "are but as yesterday," and sooner or later her beneficent work is accomplished.

In the present day many of our cemeteries are in the hands of limited companies, and the object of these companies is to pack the dead as close as possible, and thereby pay a good dividend. Undertakers are not, as a rule, promoters of sanitary burial. A grief-stricken household too often leaves all the "mournful arrangements" to these men, who derive a profit which is exactly proportioned to the degree in which nature's work is hindered.

What with shells, leaden coffins, oak cases, silver fittings, brick-vaults and vulgar tombstones, burial is a most expensive affair, and although we profess to believe that there is no rank in the tomb, a visit to the nearest cemetery will prove that in death arrogant ostentation reaches its highest pitch.

Sometimes a railway cuts rudely through a cemetery and presents us with a section of it, a section which reveals in all its ghastliness the horrors of modern Christian burial. We find the dead piled in heaps ; we find that leaden coffins have been burst by the generation of gas inside them, and that the corpse of the loved one,

> "Which at first was lovely as if in sleep,
> Then slowly changed, till it grew a heap
> To make men tremble who never weep."

Mr. Seymour Hayden did good service some few years since by drawing public attention, in language more forcible and eloquent than any which I can command, to the disgusting nature of our present mode of burial. If a body be laid in the earth, and if the earth come into actual contact with the body, its gradual resolution into its ultimate elements is effected quickly and without offence, and if the surface of the grave be planted with rapidly growing trees and shrubs, the process is quickened still more. The roots find their way to the organic matter, and in due time green leaves and fragrant blossoms speak to us in no uncertain language of a joyful resurrection.

The power of the earth to appropriate to itself all decaying organic matter is most astonishing. During the time of the plague thousands of bodies were shot into pits and covered up, and no evil has ever been attributed to this process. Those who walk up Regent Street little think that as they pass the end of Beak Street they are within a few yards of one of the plague pits of 1665, into which many thousands of the victims of the epidemic were cast.

If we wish a dead body to be decently turned again to the condition of inorganic matter, we must actually commit the body "to the earth," and we must take care that the expressive language of our burial service is not turned to a mockery and a mere figure of speech. At the most a

wicker-work coffin must be used, or a coffin so contrived that it can be withdrawn and allow the soil to come into actual contact with the corpse. Lead and oak are not to be thought of. It is the fashion to bury bodies very deeply, but it is doubtful if it be advisable to go so deeply that air and water, low forms of animal life, and the roots of plants cannot penetrate to it. Three or four feet should be enough.

Brick graves should be abolished, and it should be made illegal to bury more than one body in the same grave. Each body should be completely surrounded by earth.

Next to impervious coffins and brick vaults the worst thing is the placing of a slab of impervious stone on the surface, thereby preventing vegetation, and preventing also to some extent the access of moisture and air.

If we could all be reasonable on this point, the ceme teries of one generation ought to become the recreatio grounds of the next. Cemeteries should be on the outskirt of towns, and the builder of every new house should pa a fixed sum into the cemetery fund; for every hous in the course of time must provide occupants for tl cemetery.

The family of the deceased should have the lease of plot of ground (say 9 feet by 3) in which to dig the gra This plot of ground should revert to the community at t end of twenty-five or fifty years, when the poignancy grief would have abated, or possibly the deceased ha been forgotten. The grave should be planted with tr and shrubs most suitable to the soil, and big tombsto should be prohibited. In order to give some sc for memorials, a cloister might be erected for the recept of monuments and inscriptions.

Three or four pounds is usually paid for a grave in a pu cemetery, so that for the twenty-seven square feet necess for the decent interment of an adult, as much as three pou may be asked. At this rate 1613 persons might be bu with ease and without offence in an acre of ground, and

fees for land would amount to £4839. Counting children, we may assume that 2000 bodies could be interred in an acre. If this were done in London some fifty acres of land would be necessary for the interment of the yearly dead, which amount to some 100,000. Fifty acres is equal to the $\frac{1}{1534}$ of the metropolitan area which is estimated at 118 square miles, and it is evident from the calculation of the burial fees, that a very handsome price might easily be afforded for the land.

At the end of twenty-five years this land should revert to the community, and if this course were pursued, there would be an end of our trouble in respect of open spaces in crowded cities, for every man in dying would benefit his neighbours by giving them the reversion of twenty-seven square feet at a cost of £3 on his estate. This co-operation of the dead for the benefit of the living would solve many difficult problems, and would do something to arrest overcrowding, and would establish a certain sure relation between buildings and open spaces which is very desirable. Such a course as this would not outrage any of our feelings; it would not prevent any manifestation of respect to the deceased; it would not interfere with any religious forms, and it may reasonably be hoped that those who are shocked at the idea of an innocent child playing over the spot where an interment took place a generation back are at least a diminishing minority.

There are some who advocate cremation in place of burial in the earth, but I hold that cremation is not necessary; that it is almost hopeless to expect a general assent to the practice; that it is wasteful, and that it would often defeat the ends of justice. Burial in the earth, if decently and properly conducted, is a safe and healthy practice.

It may be hoped, too, that at least the custom will some day come into vogue of planting trees and not tombstones over the spot where those we love best repose. A tree, as a memorial, improves with age, while the mouldering, moss-grown, untidy tombstone merely teaches us that "the dead

know not anything, neither have they any more a reward, for the memory of them is forgotten."

Such propositions as those I have advocated should at least receive some assent from men of science; but it must not be forgotten that the year just passed saw the interment of the scientific chief of this country in the most unscientific way imaginable. This lamented gentleman died of typhoid fever, and it was sought to honour him by placing his remains immediately beneath the floor of a building which is thronged by thousands every week. Let Westminster Abbey be our Walhalla as far as memorials are concerned, but let us hope that we have seen the last of these interments in buildings. A President of the Royal Society who had done so much to encourage the reverend study of the laws of nature should at least have been laid where nature's laws could pursue their course without even the semblance of opposition.

In the preceding chapters we have had constant occasion to allude to the power of the earth over dead organic matter. This is seen in its highest degree in the case of the burial of a large number of bodies in one pit, as is done in times of war or pestilence.

In a less degree it is seen in what is known as the dry-earth system of treating excrement. It would be idle to contend that we understand the exact nature of the reaction which takes place between dry earth and excrement. The result of the process is none the less wonderful because we do not know precisely how the change is effected.

If a trowel full of dry earth be thrown over a dejection all offensive odour is stopped. If we examine the earth mixture at the end of a month we find that excrement and everything has been turned to good garden mould, just as the leaves swept into a heap in the autumn are changed to mould by the following summer. If we take this mould and use it a second time, we find that all has been changed to mould again after the lapse of a month or six weeks. Mould has been used in this way for

twelve times in succession without any faltering of the process, and, as far as we know, the power of earth in this direction, even independent of green vegetation, is practically unlimited, and we may infer that earth may be used over and over and over again without offence.

People talk of the difficulties of the dry-earth system, but those who talk thus have no experience of it. If each man needs one and a half pounds of dry earth per diem in order to render his excrement inoffensive and harmless, and if this earth is fit to use at the end of six weeks, then a hundred-weight of earth per head, or a supply for eighty-four days, is all that is required. There ought to be no difficulty in procuring a ton of dry earth as the annual supply for a household of twenty persons.

INFECTIOUS DISEASE

AND ITS

PREVENTION.

BY

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PREFACE.

THIS Handbook is intended to give, in a brief and popular form, an elementary account of the origin, behaviour, and means of prevention of infectious disease.

As yet our knowledge of this subject is very incomplete, but each year adds to its store. While, therefore, it has been the object of the writer to avoid as far as possible all matter which is purely speculative, it has been thought well to indicate, although but generally, the lines upon which that knowledge may be expected to grow.

June, 1884.

CONTENTS.

INFECTIOUS DISEASE

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CHAPTER I.

ORIGIN OF INFECTIOUS DISEASE.

WRITING more than a century and a half ago of the epidemic of plague which prevailed in his boyhood, Daniel Defoe makes the citizen whose adventures he recounts tell of a madness "which may serve to give an Idea of the distracted humour of the poor People at that Time"—a madness which consisted of "wearing Charms, Philtres, Exorcisms, Amulets, and I know not what Preparations to fortify the Body with them against the Plague, as if the Plague were not the Hand of God, but a kind of a Possession of an evil Spirit; and that it was to be kept off with Crossings, Signs of the Zodiac, Papers tied up with so many knots, and certain Words and Figures written on them, as particularly the Word Abracadabra formed in Triangle or Pyramid." And further, "How the poor People found the Insufficiency of those things, and how many of them were afterwards carried away in the Dead-Carts, and thrown into the common Graves of every Parish."

The time for belief in such superstition is long past, but if the knowledge of our time is to be judged by that of the greater number, it cannot be said that we are free from much opportunity for criticism. Charms have been abandoned, but have not always been replaced by more trustworthy means of protection against disease. We have,

indeed, often only exchanged the philtres of 1665 for "some futile ceremony of vague chemical libations or powderings."

The enemy with which we have to contend in our time is not less hostile than in the time of Defoe. It needs but the chances we may give it to compass our destruction. Causing year by year one-fifth of the deaths which occur among us, it is far more to be dreaded than the most terrible of wars: dreaded because "the pestilence that walketh in darkness" is an invisible enemy, and escape from it appears at first sight less easy than from one which can be seen and faced. Nevertheless it is regarded as "preventible" beyond all other causes of death, but for its prevention we must clear away the darkness with which it is surrounded, and by the light of day learn the weapons with which it fights. Before all things we must know our enemy. We must learn how it comes into existence, the material of which it is made, and the manner in which it carries on its war. Then, and then only, shall we be able to bring to bear against it the weapons with which nature has armed us for our preservation.

But it may be asked, How is this knowledge attainable? Many channels of investigation are forbidden to us, and difficulties as a result meet us at every turn. Nevertheless we are not without the means of gaining knowledge, although it comes to us more slowly than if we might arrange a number of carefully thought out experiments. Nature is herself constantly bringing before us experiments of her own creating, but alas, too often under conditions which prevent their true lessons from being learnt, and at a yearly cost of life which is simply appalling. Still many outbreaks of disease require but investigation to tell us how they have their origin. Thus we have learnt in the past, and so we may hope to learn in the future, the various conditions under which disease is caused, and, by the careful study of those conditions, know how disease may be avoided.

How, then, are infectious diseases caused?

We can understand how an unhealthy trade, such, for instance, as knife-grinding, may cause disease of the lungs through the inhalation of irritating particles of dust given off in the process of manufacture ; how are produced those ailments due to wet and cold, or those changes in the tissues which accompany advancing years ; but there is something about the diseases we have to consider which separates them very widely from those which may result from an unhealthy occupation, from exposure to the elements, or from old age. Diseases which can be communicated from one person to another differ very widely from all of these, and in studying them we cannot but be impressed with the fact that in certain particulars they broadly resemble one another.

They do not apparently affect their victim the very moment he is exposed to them ; but there is a period of latency or *incubation* between the time when the poison is received and the appearance of the symptoms resulting from it. They do not last an unlimited time, but within a certain period end in the death or the recovery of the sufferer. Again, the person who comes in contact with another suffering from one of these diseases develops the same disease as that to which he was exposed, and is, as a rule, exempt for the rest of his life from further attack from the same affection, however often he may be exposed to it. Finally, he may, during his own illness, and especially at certain periods of it, impart his ailment to other susceptible people.

Such affections, then, differ very much from all others. They resemble the planting of a seed in a fertile soil. There is, first, the interval when nothing is seen, but during which changes undoubtedly take place, leading eventually to the appearance of a plant upon the surface. This in turn grows, reaches a maximum of development, becomes itself laden with seed, and perishes, but leaving the seed to give origin to a thousand fresh plants wherever a suitable soil may be found for their development.

No particle of steel, no exposure to cold, will give rise to

results such as these. Whatever causes such a succession of events must share with the seed one special property: it must above all things possess *life*, a life of its own, not perhaps always active, but always ready to be called into activity the very moment the conditions for its growth can be found.

It was in 1836 that Cagniard de la Tour discovered the yeast plant, and enabled the phenomena of fermentation to be explained by the growth of this organism. When yeast is added to a warm solution of sugar, changes rapidly take place in it, gases are given off, and alcohol is produced in the solution. If the sugar solution be kept free from such organisms, these changes, which we know by the name of fermentation, will not take place; again if the solid particles of yeast be excluded from the sugar solution by a fine filter, or if a solution of sugar containing yeast be boiled, no fermentation will occur. Fermentation only results when the living solid particles of the yeast themselves come in contact with this sugar solution. If the yeast be examined under the microscope it is found to consist of small minute globular or ovoid bodies, each made up of semi-fluid material surrounded by a thin wall. Each of these bodies or "cells" is called a Torula, and it is to the growth of these Torulæ that fermentation is due. When a Torula is placed in a saccharine solution which is kept warm, it throws out tiny buds, which increase in size, and then become separated from the original cell, each in turn producing fresh buds often before they are separated from the parent Torula: thus strings of Torulæ are frequently formed. But no Torula ever exists which has not been produced by a previous one.

For years after its discovery it was not fully recognized that fermentation was due to the *growth* of the plant. It was thought by many that its death was the exciting cause of fermentation. The immediate cause of fermentation had not been understood.

It is now nearly fifty years since the discovery was first made that an infusion of meat could be prevented from

decomposing if all the air which was permitted to come in contact with it had been exposed to a flame, and thus the lesson was learnt that the changes known as "decomposition" are really due to something the air contains. At a later stage, Pasteur showed conclusively that decomposition in an organic fluid could alone occur as the result of some organism; and that it was possible by boiling to destroy any living organism or "germ" an infusion might contain, and preserve it from decomposition, so long as all the air which came in contact with it had been carefully filtered through cotton wool, so as to prevent the admission to it of these germs.

Another lesson was learnt when it was shown that these germs might be dried and kept in this condition for long periods of time without losing their vitality, and that they might indeed in some cases be exposed to the action of acids without injury, while in others, if exposed to the same acids, their vitality might be destroyed.

Now the admission of a tiny particle of the yeast plant into the solution of sugar, or of the minutest quantity of a fluid containing the germs of decomposition into an infusion of meat, is sufficient in a very short period to lead these fluids to be permeated throughout with the organism with which they are infected, so rapid is the growth. Again, if other fluids be prepared, entirely free from these organisms, they in their turn can be inoculated in the same way by the minutest particle taken from the fluids previously infected, and so it becomes possible to give origin to millions upon millions of these minute organisms, each of which in its turn, if opportunity be afforded to it, by the provision of a suitable soil, may develop into an indefinite number of others.

To the discovery of the yeast plant we are indebted to a larger extent than it is possible to tell for our knowledge of infectious diseases. When but a few of the facts that are here stated were known, the clear mind of the late Dr. Farr recognized a similarity between the process known as fermentation and the behaviour of infectious disease. Just as

the minutest particle of yeast is able to produce changes in a large quantity of sugar, so the smallest quantity of matter taken from the vesicle of a person suffering from small-pox, and placed beneath the skin of another person who has not previously suffered from this disease, and who is not protected by vaccination, is capable of infecting the whole of the body, and covering the skin with many vesicles of the same kind, multiplying the poison over and over again. So Dr. Farr learnt to place together a number of diseases which are caused by the introduction into the body of a something which must undoubtedly have as definite an existence, whether we can see it or not, as the Torula that Cagniard discovered nearly fifty years ago; and to this group of diseases he gave the name of "zymotic," from the Greek *zymosis*, or fermentation.

Since that time the evidence in favour of this opinion has continually grown. In the bodies of those who are suffering from, or who have died from, some of the infectious fevers, are found organisms which there is some reason for believing stand in the same relation to these affections as the yeast does to the changes of fermentation. In the blood of persons suffering from relapsing fever have been found small bodies called *spirilla*, looking like small spiral threads, and capable of movement; and again, in enteric fever and cholera, and many other communicable diseases, have been found certain microscopic organisms. But though complete proof is still wanting for some of these affections that these organisms are the *cause* and not merely the *result* of the disease, it is clearly afforded in the case of two diseases which attack the lower animals. The first, Anthrax, a fatal form of disease amongst cattle and sheep, is undoubtedly produced by an organism which is known by the name of the *Bacillus Anthracis*, and which is found in the blood and tissues of animals which are affected with this disease. This organism appears in the form of minute rods, so small that 1250 of them placed end to end would be required to measure one inch, and so narrow that 18,000 placed side by side would make up the

same measurement. They can be removed from the body, and cultivated in an appropriate fluid, and their mode of development has thus been studied. These rods multiply by first increasing in length and then dividing. Bright specks called spores (which we may roughly compare to eggs or seeds) also appear at various points in the length of these rods, and become free when the rods disappear. Although the rods are easily destroyed the spores are very tenacious of life. A few rods or spores introduced into a suitable cultivating fluid will rapidly develop in it, and this may be repeated any number of times, and finally, when the product is introduced into the body of an animal, will infect this creature with the disease, proving that this organism is the cause of the affection. This disease is the more worthy of study for the reason that the same organism, the *Bacillus Anthracis*, is the cause of fatal disease in man.

Again, Dr. Klein has proved by his investigation of the disease which is usually known under the name of pig-typhoid, or pneumo-enteritis, that a specific organism is the cause of this highly-contagious malady. As in the case of the poison of anthrax, he has succeeded in growing it outside the body, again producing the disease when it is once more introduced into the body of a pig.

With regard to both of these affections, as well as ordinary putrefaction and fermentation, we can prove that the cause of each is the growth of specific living organisms, and we can have little hesitation in affirming that the same is also true in the closely analogous cases of other infectious diseases, even in those in which no definite organism has yet been detected. We may leave with assurance to the future the absolute proof for which it is still necessary to wait. Already, therefore, we begin to see that our enemy is a living being, that it preys upon our bodies, and is perhaps in some cases dependent upon them for its own existence; and that every human being with whom it takes up its abode provides the food for its multiplication and growth.

We know that from scarlet fever, scarlet fever alone results; from small-pox, small-pox; from measles, measles. Are we then to assume that every case of these diseases which occurs must have originated in a previous case of the same disease? The experiments of Pasteur have shown that the growth of organisms in the flask is dependent on the entrance of organisms into its contents, but the experiment which can be performed in the laboratory is less easy in the outside world. We shall shortly see that filth and disease go hand in hand, leading many to the belief that dirt unaided can produce infection.

The late Dr. Budd, almost more than any other observer, insisted that every case of infectious disease must owe its origin to a previous case of the same nature.

Recognising that disease is found under all sorts of conditions, but particularly amongst those where filth prevails, he carefully sought for an antecedent case wherever others were to be found, and met with a success which has been encouraging in the highest degree to those upon whom have subsequently devolved similar labours. Just as Pasteur's flasks failed to develop their countless organisms until the admission of unfiltered air carried from without those "germs" which were to act as parents, so the filth which Dr. Budd found in many a cottage failed to give rise tc disease until the seed was brought in a manner which through his investigations subsequently became known.

Still we must admit that success does not always attend these efforts, and that there are occasions when antecedent disease cannot be found. In a remote country district where the movements and condition of health of each individual are known, and where there is no reason to suspect importation of disease, infectious sickness will sometimes appear. There are, however, some possibilities that cannot absolutely be eliminated: one is that a person may have suffered from so mild an attack of one of these affections that even his own suspicions are not aroused; another, that one of the lower animals may have been the medium of communication; or again, we are rarely able to

exclude the possibility of these "germs," especially of those very persistent varieties which have the power of forming spores, being carried by the wind or clinging to unsuspected articles of food, clothing, &c., and remaining latent for possibly a long period, until they alight upon a suitable soil; for as yet our knowledge of the relation between the diseases of the lower animals and of man is too scanty to enable us to form any other conclusion on this point than that the possibility cannot be absolutely denied.

Wherever importation of infectious disease cannot possibly have occurred, there we find the inhabitants exempt under whatever conditions they are living. Take for instance the freedom of the Faroe Islands from measles; for sixty-five years before 1846 not a single case of measles had been known to exist in these islands. Occupying an isolated position, the probabilities of disease being brought to them from without were remote, and whatever the condition of the islands, it does not appear to have been capable of originating a single case of this disease. Yet, like Pasteur's flask, the material for the development of the disease when once introduced, existed in abundance for in 1846 a sailor suffering from measles was brought into, one of the Faroe Islands and "led to an epidemic which attacked more than 6000 out of the 7782 inhabitants, sparing only the persons who had previously had the disease and 1500 others who were kept out of reach of the contagion."

A similar story is told for another part of the United Kingdom by Mr. John Simon, in the 6th report of the medical officer of the Privy Council: "England has 627 registration districts. During the 10 years, 1851–60 scarlatina, small-pox, and measles were, as usual, prevailing more or less throughout the country, producing among children under five years of age an average annual mortality of 802 per 100,000; i.e., by scarlatina, 419, by small-pox, 103, and by measles, 280. In 626 of the registration districts there were deaths (and, for the most part, in not inconsiderable quantity) from one or more of these causes;

not quite invariably from all of them; for 43 of the 626 (thanks, no doubt, to vaccination) had not any death by small-pox, and among the 43 districts which thus escaped mortality by small-pox, there was one which also had not even a single death by measles; but, with these exceptions, all the 626 districts had deaths from the three diseases—deaths by measles, deaths by small-pox, deaths by scarlatina. But the 627th district had an entire escape. In all the ten years it had not a single death by measles, nor a single death by small-pox, nor a single death by scarlet fever. And why? Not because of its general sanitary merits, for it had an average amount of other evidence of unhealthiness. Doubtless the reason of its escape was that it was insular. It was *the district of the Scilly Isles*, to which it was most improbable that any febrile contagion should come from without. And its escape is an approximative proof that for at least those ten years, no contagion of measles, nor any contagion of scarlet fever, nor any contagion of small-pox, had arisen spontaneously within its limits. I may add that there were only 7 districts of England in which no death from diphtheria occurred, and that, of those 7 districts, the district of the Scilly Isles was one."

It is almost impossible to believe, in face of such evidence, that if filth could create *de novo* the living organisms which we must regard as the cause of infectious disease, that these islands would have escaped for so long a time.

Before leaving the theory of spontaneous origin we must think for a moment of a reason which has been urged on its behalf. Infectious diseases, it has been argued, must at some period of the world's history have had their beginning, and if any circumstances could have given rise to them in the past, there is no reason why the same circumstances might not give origin to them in the present. To this we can but answer with a question of Charles Darwin, are we to "really believe that at innumerable periods in the world's history certain elemental atoms have been commanded suddenly to flash into living tissues?"

The lessons which may be learnt from Darwin must surely apply equally to the organisms of infectious diseases.

How rapidly disease-producing poison may be modified by the circumstances surrounding its existence it is impossible to say. Experimenting with material taken from the abdominal cavity of a dog which had died from inflammation of the peritoneum, Dr. Burdon Sanderson found that, when injected into the abdominal cavity of another dog, the virulence of the poison was rapidly increased, and thus it was possible, by the passage of this material through a number of dogs, to breed a poison which was as intense as that of a snake. So also it is suspected by some that diphtheria will result from a simple sore throat, developing its true characters after passing through successive individuals.

But we have already dwelt enough upon the origin of infectious diseases to show that we have a vital organism to deal with. In some of these affections these organisms have not been found, but it is as impossible to doubt their existence as it would be to question that the growth of a plant must have resulted from the seed of some previous plant. How they originate we cannot tell.

We cannot deny the possibility of disease attacking man through an organism whose natural home is not the body of an animal, for the researches of Tommasi, Crudeli and Klebs have shown us that an organism found in the air and soil of malarial districts, gives rise, when inoculated into dogs, to symptoms of malarial disease, the organism being found situated in their spleens, and Crudeli has claimed to have discovered the same organism in the blood and spleen of man when he is the victim of malarial affections. Malarial disease is not communicated from man to man like measles or small-pox, but the growth of its organism outside the body leads us to think of the poison of enteric fever and of cholera, which exist and have a power of development in water, and which may be communicated from man to man.

CHAPTER II.

CHANNELS OF COMMUNICATION OF INFECTIOUS DISEASE.

WHEN a human being receives into his body infective material and subsequently suffers from any of the infectious diseases, at some stage or other of his illness he gives off the same poison multiplied in quantity an unknown number of times, and capable of giving the same disease to other persons who come within "striking distance" of the poison. But of a number of people who come within this distance not all will become victims to the disease. It is necessary for the germination of the seed that it should fall upon fertile soil, and not every one can provide the soil which is required. The circumstances under which one person is more susceptible to these diseases than another are but imperfectly known, but one fact comes out very clearly with regard to all of them. A person who has suffered from one of these illnesses is to a very great extent protected from subsequent attack of the same disease, however freely he may afterwards be exposed to infection.

What is true for the individual appears also to be true for communities, and thus we are led to believe that protection against infectious disease can be to some extent inherited. As an instance, let us contrast the behaviour of measles amongst European races with that amongst the Fiji islanders.

Measles had never been known in these islands, until their cession to England opened up communication between the islanders and European races, and afforded opportunity for the introduction of disease. In the beginning of January, 1875, the king, Cacobau, returning with his sons and retinue from a visit to Sir Hercules Robinson, in Sydney, where measles was prevalent, brought this affection into

the island, one of his sons and his servant having contracted the disease. Measles was also introduced immediately afterwards by one or two other ships, also coming from Australia. The disease first appeared amongst the native constabulary, whose duty it is to board all vessels, attacking the whole number, 147 of them, those being first attacked who boarded the king's vessel. A meeting of chiefs from all parts of the island was held immediately after Cacobau's return, and these subsequently returned to their homes carrying with them the disease which they had contracted. The result was that within four months, of a population of 150,000, 40,000 were dead of measles.

It has been argued, and probably with some truth, that much of this high mortality was due less to the intensity of the poison than to the fact that whole villages being attacked at the same time, there was no one to take charge of the sick, who exercised no control over their conduct and exposed themselves freely to the night air, often lying down in the streams to cool themselves in their fever.

When, however, the behaviour of measles in England is recollected, how numbers of people have but a few days' poorliness, and are not incapacitated from the performance of their daily duties, it does not appear probable that this explanation will wholly account for the difference between the mortality of this disease in England and in Fiji. Measles has existed in England for an indefinite period, and, although very gradually, has weeded out during successive generations those persons who were most susceptible to its influence, leaving the more insusceptible to continue a less susceptible race.

The protection which an individual acquires from having previously suffered from such disease tends to be weakened as time goes on, year after year making him apparently less insusceptible than he was immediately after his first illness. There are some conditions of life which appear to interfere with the protection afforded by a previous attack. The great changes which take place at that period of life which we know as puberty may be reckoned as

acting in this manner. Again, it is believed a severe illness of some other kind, or perhaps in woman the birth of children, will bring about the same result. Period of life also has its relation to susceptibility to the influence of infection; children in very early infancy often escape, where those a little older suffer; again, a riper age seems to give protection against attack from one affection, viz., enteric fever, while younger persons contract it more readily.

The inability of the poison to develop in the body of an individual who has suffered from the same disease is limited to that disease alone; a previous attack of scarlet fever protects against scarlet fever only, but not against small-pox, measles, or any other affection. So we may carry our simile of the cultivation of infectious diseases to the growth of seed a further step, and show that the farmer, when he finds the advantages of an alternation of crops, has the same experience of their behaviour which we have of that of these maladies. From this knowledge we must learn one of our lessons in the prevention of infectious diseases. If we are to prevent the extension of any one disease, we ought when possible to permit only those to come in contact with the sick who are themselves rendered insusceptible by a previous attack of the same disease. Prevention of infectious disease must therefore depend upon the avoidance of infection by susceptible persons, and this may be brought about in one of two ways:

A. The prevention of the development, or of the means of communication of the infection.

B. The prevention of the susceptibility.

Although the channels of communication of infectious disease are somewhat numerous, their ultimate end is that they may enter the body in one of three ways: either through the respiratory passages, inhaled by the breath; through the alimentary passages, taken in by swallowing; or through the skin.

By far the greater number of these affections are conveyed in the first way; it cannot, however, be stated positively that the air-borne infection having reached the entrance to

the respiratory passages may not eventually find its way into the alimentary canal. A smaller number reach the alimentary canal, through food which may be infected by the excreta of a person suffering from the ailment, or in some other way not yet fully known.

With reference to the third group of diseases received through the skin, it is impossible to say whether this should be limited to small-pox, which is inoculable, or whether it should also include those affections which are also received through the respiratory passages; for without a carefully designed experiment it would be impossible to secure contact of the skin of the recipient with that of the sufferer without the air passage being exposed to infection at the same time, and thus causing uncertainty as to the channel of infection.

What we already know of the manner in which infectious diseases are communicated enables us to roughly classify them as follows:—

Communicated by means of the excreta by air, water, and infected articles.

Cholera.
Enteric fever (typhoid fever).

Communicated by food (milk).

Enteric fever (typhoid fever).
Scarlet fever (scarlatina).
Diphtheria.

Communicated by air, contact with sufferer, or infected articles.

Scarlet fever (scarlatina).
Diphtheria.
Typhus fever.
Measles.
Rötheln.
Mumps.
Relapsing fever.
Whooping cough.
Chicken-pox.
Small-pox.

Diseases which spread through the Excreta.

Our table shows us that there are two diseases in whicl the poison resides chiefly, if not altogether, in the bowel of the sufferer. It will be better for us in learning hov they may be prevented to consider each separately.

The first, *Cholera*, is not always present with us, no indeed in most other parts of the world; its home is i India, whence it spreads from time to time under circum stances which are still the subject of much doubt an debate. The opportunities for the investigation of th manner in which it spreads in India are surrounded wit difficulties in that country, as indeed in our own to a ver much less extent. There are a number of persons wh every year die from what we know under the name c diarrhœa or English cholera, a disease wholly distinct fro that of Asiatic cholera, but presenting symptoms so muc like it that it is often difficult to distinguish between tl two; hence any attempt to trace the spread of Asiat cholera is rendered exceedingly difficult in a country whe other bowel diseases are always present to a large exten We shall, therefore, be acting wisely if we learn our lessc from the behaviour of cholera in England, where it is f more possible to trace the affection from one person t another and distinguish between persons suffering from and those who have other ailments.

During the present century cholera has invaded Englar on four separate occasions, in 1830, in 1848, in 1853, ar in 1865. The late Dr. Snow was led by the study of tl second outbreak to believe that cholera was communicate through water, an opinion which received much confirm tion from an outbreak which occurred in the neighbourhoc of Golden Square in the next epidemic.

The story of the pump in Broad Street, Golden Squar and the way in which it gave cholera to persons in tl surrounding district has been so often told, that an apolog is almost required before repeating it, but it teaches

important a lesson that it is no matter for surprise that the story is told again and again. It is one of the best illustrations of the way cholera may be communicated by water; for not only did 486 persons living within two hundred yards of the well and drinking the water, lose their lives within eight or nine days, but the water had a reputation for excellence of quality, and was sent for by persons residing at a distance, leading to an outbreak of the same disease in a family living at Hampstead, who happened to consume it. An examination of the well showed it to be contaminated by the drainage of a house in which a case of so-called diarrhœa had occurred. The removal of the pump-handle led to the cessation of the outbreak.

At a later date, in 1865, another well-known outbreak occurred in the village of Theydon Bois, in Essex. Here the disease was undoubtedly brought by a gentleman and his wife who had been staying at Weymouth, and who on their way home were attacked with diarrhœa and cramps, from which the wife subsequently died. Mr. Simon tells us that after their return "within a fortnight in that one little circle eleven persons had been seized with cholera—mother, father, grandmother, two daughters, son, doctor, serving-lad, servant-maid, labourer, and countrywoman; and of those eleven only three survived—the son, a daughter, and the serving-lad; later, in the countrywoman's family there was another fatal case. It cannot well be doubted that the exciting cause of this succession of events was in some way or other the return of the parents from Weymouth; of the father with the remains of choleraic diarrhœa still upon him, of the mother with apparently the beginning of the same complaint; but this is only part of the case, and the remainder teaches an impressive lesson. All drinking-water of the house came from a well beneath the floor of the scullery, and into that well there was habitual soakage from the water-closet." *

* Eighth Report of the Medical Officer to the Privy Council.

The outbreak of cholera in 1866 will be in the memory of the majority of those who will come to read these pages. It will be recollected that London did not suffer equally over its whole area, but that the eastern part of the metropolis was attacked more severely than other parts. The explanation of the disaster was due to Mr. Netten Radcliffe, who investigated the outbreak; he found that the disease began amongst those who received their drinking water from the mains of the East London Water Company, that this company was in the habit of drawing its supplies from the river Lea, and that owing to a defective supply from its filter beds, it had drawn its supplies from a source which was known to receive the drainage from a number of houses. At this time two men who had come from Rotterdam took up their abode in one of these houses, where one or both were attacked with cholera, the pollution of the river by their excreta furnishing an explanation of the subsequent outbreak. As confirmatory evidence that the water of this East London Water Company was the cause of the disease, may be cited the escape from attack of the pupils resident in a school situated in the middle of the infected area, but having a well of their own from which alone they received their drinking water.

The same kind of evidence has been found over and over again; in Scotland Dr. Stevenson Macadam showed that the propagation of cholera resulted from the pollution of drinking water, and that the disease ceased when a pure supply was obtained. So again, Dr. De Renzy pointed out that where sanitary improvements in India had taken place which had not included the provision of a pure water supply, there the mortality from cholera was not affected. Later, we have Dr. Koch, the chief of the German Commission, now engaged in India, finding in the intestines of human beings who have died from this disease, an organism which he believes to be intimately associated with its production, and further finding these organisms in a tank in the village of Sahib Bagau, a suburb of Calcutta, where an epidemic of

cholera was in progress. The water was used by about one hundred persons living near, of whom seventeen died, and its use was not limited to supplying drinking water, but served the inhabitants for purposes of bathing and washing, and in it the linen of the first fatal case of cholera was washed. The organisms were found in greater number in the first sample of water collected, becoming less numerous as the epidemic declined.

It has been more than once asked how water once polluted in the manner we have described, ever becomes again free from infection. As yet such a matter can be ground for speculation alone, but any difficulty which may be felt in finding an explanation for the subsequent freedom of water from infection certainly should not stand in the way of a willingness to accept such evidence of its pollution as already exists.

There is also evidence that cholera can be conveyed by air. It will easily be understood that unless the excreta are carefully dealt with there is risk of such an accident happening by their being blown from their place of deposit or from soiled linen towards susceptible persons. In 1866 an outbreak in the City of London Workhouse was attributed by Mr. Netten Radcliffe to the air from a sewer containing cholera excreta.

Another method by which the contents of the alimentary canal of a person suffering from cholera may cause disease is well illustrated by a story told by Brigade-Surgeon J. B. Scriven. Dr. Scriven was, while in India, called to a case of cholera in the person of a young child who was being attended by its father, mother, and several other women. Dr. Scriven cautioned these people against the risk of permitting any of the discharges from the child to come in contact with their lips; while he was doing so, he noticed that the father persisted in kissing the child, and one of the women was wiping her mouth with a handkerchief which had been used for the child's face. Subsequently both these persons were attacked with cholera, the father dying, and they were the only members of the whole group who

were attacked. It cannot be doubted that the disease was conveyed in this manner from the patient to its attendants.

Enteric fever, the second disease which is spread by the excreta, is communicated in the same way as cholera, that is to say through the poison being conveyed by water, by air, or by infected linen, or the hands of attendants, as already described by Dr. Scriven. It is moreover also conveyed through milk, but of this we shall speak more in detail later.

Instances have occurred over and over again in which drinking water has been the channel by which the poison has been introduced into the bodies of those who have contracted the disease. There is no better example of the direct infection of drinking water than that afforded by the outbreak of enteric fever in the Caterham Valley in 1878, which was investigated by Dr. Thorne of the Local Government Board. Dr. Thorne found that forty-seven persons had been attacked with enteric fever in the fortnight ending February 1st of that year; the disease was not confined to any special class of houses, those belonging to both rich and poor having suffered alike. By far the majority of the houses drained into separate cesspools, therefore no common system or drainage could be held responsible; it was further found that thirty-three of the houses affected received their milk from at least five different and completely independent dairies, and that at the remaining two private cows were kept; milk therefore had nothing to do with the cause of the disease, and it was also evident that personal infection could not have led t the outbreak. Until this time Caterham had been ve free from enteric fever; it was observed that of the fort seven persons attacked during the fortnight, forty-fi resided in houses where the water of the Caterham Wa works Company was in use; the other two were know have drunk the same water elsewhere. It was also obse that the Caterham Asylum, containing 2000 patients the Caterham Barracks, where 500 men resided, had er

escaped, and both these institutions had independent water supply from deep wells.

At the same time the neighbourhood of Redhill was also invaded by the disease; in Redhill are 1700 houses, of which 924 received water from the Caterham Waterworks Company, and of 96 houses affected during the same fortnight, 91 drew their water from this source; of the remaining five the inmates had been also known to have drunk the same water. Additional evidence was also obtained by Mr. E. L. Jacob, the medical officer of health to the district, which proved conclusively that the water was the cause of the disease, but the manner in which it became polluted was not at first obvious, probably it would never have been discovered if previous knowledge had not already taught that these diseases do not arise *de novo*. The explanation was, however, at last forthcoming; some work had been going on in one of the wells of the Waterworks Company which required men to enter the well, and one of these thus employed went through an illness which there can be no doubt was enteric fever. It was proved in the clearest manner that the well water was polluted under these circumstances, and it is interesting to observe that the occurrence of enteric fever amongst the drinkers of the water took place a fortnight after the pollution of the water began, this fortnight representing the usual incubation period of the disease.

One other example of the spread of enteric fever by water may be referred to, that of the outbreak in Caius College, Cambridge, in 1873. This instance is particularly instructive on account of the certainty with which were substantiated the conclusions arrived at, and the method by which the disease was disseminated.

The investigation was conducted by Dr. Buchanan, now Medical Officer to the Local Government Board, and showed that while there was some amount of enteric fever in Cambridge, there was a special incidence of the disease on Caius College, and especially upon the students occupying rooms in Tree Court. The College was supplied with water on

constant service, and while every water closet in the other part of the building was provided with a cistern proper to itself, those in Tree Court buildings received water direct from the high-pressure constant-service water pipes. The pipe which supplied the pan of the water closet also sent a branch or weeping pipe to a small trap in the safe, which received any splashings from the pan, and was so arranged that this trap received a supply of water at the same moment as the pan. A water valve was provided which was intended to prevent the return of any air or fluid either from the pan or the small trap into the water pipe.

Dr. Buchanan ascertained that on certain occasions the pressure of water had not been maintained in the mains, and that a back current must have taken place as the result; also that the small trap was liable to pollution from splashings from the larger trap, that the water valve could not be relied upon, and that chemical analysis of matter found at the end of the weeping pipe proved that excrementitious matter had absolutely been sucked up into the water main and thence been distributed to the pipes supplying water for drinking purposes.

Proofs of the production of enteric fever by pollution of water supply are of constant occurrence. Every year adds to the list of cases to which reference might be made. The report of the Medical Officer of the Local Government Board just issued, gives an account of a serious epidemic of enteric fever in Bangor in 1882, in which nearly si hundred persons, out of a population of ten thousand, wei attacked with the disease, the outbreak being traced to th infection of a stream supplying water to the town. N must we forget to make mention of the spread of disease to 113 persons who drank lemonade and eat at a regatta, the water from which these were prep coming from a well which was shown to be liab contamination.

That air, too, may under certain circumstances act carrier of infection, will of course be readily seer W. B. Carpenter writes of an outbreak which too'

in a large and airy house standing by itself in a salubrious situation, and in which four members of one household were attacked with typhoid, the particulars of which he had the opportunity of learning on the spot. "The most careful examination failed to disclose any defect in its drainage or its water supply. There was no typhoid in the neighbourhood, and the milk supply was unexceptionable, but the neighbouring house being old, and having been occupied by a school, its removal had been determined on to make way for a house of higher class, and as the offensive odour emanating from the uncovered cesspool was at once perceived in the next garden, and the outbreak of typhoid followed at the usual interval, the case seems one which admits of no reasonable question." *

While air can thus convey the poison of enteric fever it does not appear to do so in any other way than by the carriage of infection from the excreta. In a hospital ward, well ventilated and kept in a proper state of cleanliness, disease does not spread to other patients if a person suffering from this fever be introduced amongst them unless they come into such close contact as would admit of their hands becoming soiled with infectious material which may subsequently be conveyed to the mouth, an accident which from time to time must happen amongst nurses unless great care be exercised.

Contact appears to be required for the extension of enteric fever, either with the patient or his discharges; but when this occurs, the spread of the disease will, even in well arranged hospitals, occasionally result.

Dr. G. C. Henderson, now of Jamaica, who was, until lately, Assistant-Physician to the London Fever Hospital, when acting as medical officer to another institution, had under his charge a ward in which were placed persons suffering from affections other than fever; into this ward was admitted a woman who was passing through an attack of enteric fever, and who was placed in a bed amongst the

* The Germ Theory of Zymotic Diseases. *Nineteenth Century*, February, 1884.

others. During an alarm of fire, the delirious fever patient left her bedroom, and sought refuge in that of another patient, with whom she was in contact for a few moments, and who was the only one of some fifteen or twenty who subsequently contracted the disease.

Again, in a house in Kentish Town, there lived during last year, three families, consisting of six adults and two children on the first and second floors, and two adults and six children on the ground-floor. First a child living on the ground-floor died of a disease lasting three weeks; but which the father described as the "fever." When the infant died, the mother and two other children, of the same family, took to their bed with an attack of enteric fever. Nine days after, a fourth child of the same family sickened with the same disease, a week later, a fifth child, and shortly afterwards, a sixth. The excreta were thrown down the one watercloset of the house, which was situated immediately outside in the backyard; the water-closet was also used by the eight other persons residing in the house, of these all escaped but one, and this one was one of two who tended the sick in the room below during their illness.

Here only those contracted the disease who came into close proximity and even contact, with the sick, giving opportunity for disease to be conveyed, as in the cases mentioned by Dr. Scriven.

Only a few months ago the writer, in endeavouring to ascertain how enteric fever had come to make its appear ance in a house in the parish of St. Pancras, was perplex by at first finding no direct cause for its existence. Ente fever had recently been widely disseminated through infected milk supply, and a woman living in another r of the district had been attacked as a result. Her s whose illness subsequently became the subject of ir gation, had not for some time before, or during the had any communication with the first case, nor h been exposed to the same condition which had rise to it. Her own illness only came to be ex

when it was found that the mother of both women had brought to the second house linen soiled with the discharges of the first case, and that she had been employed in washing it.

A similar instance is quoted by Dr. Thorne, as having been recorded by Dr. Gilbert Child. A family living in a village in Oxfordshire, consisting of a woman and her son, were joined on November 20th, 1873, by another son, who brought with him "several boxes of very filthy bedding, clothes, &c." On the 29th his brother was attacked with enteric fever, and afterwards died, and on the following day his mother also fell sick of the same disease. The cause of infection could not be ascertained until it was found that he had brought with him the dirty bedding and clothing of his wife, who died of enteric fever in the previous September, in Toronto. But one other case of enteric fever occurred in the village, that of a woman who was attacked on December 5th, and who had been employed in washing the dirty clothes.

Time does not always appear to diminish the potency of the poison, numerous instances are recorded in which a house has retained infection for years. Thus Dr. Thorne writes, "I know a detached house which stands in large grounds in a country district, and which was occupied by a groom and his family, amongst whom enteric fever prevailed in the autumn of 1872, one case being fatal. This family continued to occupy the house for nearly two years after this occurrence; but they left it some time in 1874, in consequence of the departure of the owner of the estate on which it stood. From that date, the house remained unoccupied until February, 1876, when it was tenanted by new inmates, and exactly within fourteen days of these latter taking up their abode there, enteric fever broke out amongst them, and a most careful inquiry led both the medical men in attendance and myself to the conclusion that the disease was not imported.

So far as we have as yet gone, the two diseases, cholera and enteric fever, spread under conditions which are practic-

ally identical, conditions which always include the conveyance of the excreta, or of some poison derived from the excreta, from a person previously infected with this disease, to those who subsequently develop it; but in the latter affection, our knowledge has gone a step further, we have learnt that the poison may be conveyed not in water alone, nor by air alone, but by a common article of food—*milk*.

DISEASES WHICH SPREAD BY MILK.

Since Dr. Ballard first traced, in 1870, an outbreak of enteric fever in Islington to a particular milk supply, and directed attention to this mode of propagation of disease, a number of other outbreaks have been clearly proved to be due to the same source. In the Islington epidemic, and again at a later date in Marylebone, when another outbreak occurred, there was considerable reason for believing that the milk became contaminated by means of polluted water used for washing the milk pails—water previously contaminated, at any rate in the latter instance, by excremental matter from a person suffering from enteric fever. Without doubt milk would afford an excellent growing ground for the development of an organism which has the power of self-multiplication in water, and give the introduction of the poison, even in the smallest qu tity into the milk, its further development and influe upon the milk-drinkers is easily understood. But absence of evidence of such contamination is not ir quent, so much so, indeed, as to lead to the susp that milk may come to cause enteric fever under other circumstances than the addition to it of the excreta of man.

In writing, therefore, with such knowledge as possess, we must not assume too absolutely that tension of enteric fever through an infected mi must have necessarily resulted from its contami

the excreta of man, although such contamination, when it does occur, is an ample cause of disease.

There is another reason for keeping our minds open on the question of the manner of infection of milk with the poison of enteric fever. This is not the only disease which is propagated by milk; there are two others which are certainly spread by this means, and in these, it is important to note, the poison is *not* known to reside in the excreta of those suffering from them. We refer to scarlet fever (scarlatina), and diphtheria. There is a complete absence of any proof that the poison of either of these diseases has been conveyed by drinking water, as in the case of cholera or enteric fever; wherever there have been large outbreaks of either scarlet fever or diphtheria, they have resulted from personal communication between one person and another, or by means of infected milk.

That scarlet fever could be caused by infected milk was first discovered by the late Professor Bell, of St. Andrew's, who investigated an outbreak of scarlet fever in that town in 1870, and believed that the milk became infected by the milk carrier and her children, who were suffering from this disease.

Other epidemics have been shown very conclusively to be due to this cause, as one of recent date may be mentioned, that in Bloomsbury in 1883, which was investigated by Mr. Power of the Local Government Board, and Mr. S. R. Lovett, Medical Officer of Health of St. Giles'. In this case it was shown that the milk coming from a particular dairy in St. Giles', was responsible for the disease in that neighbourhood, and in St. Pancras. The milk was received by the dairyman from a farm in Surrey, some portion of it also being distributed in the parish of Camberwell, where it was received direct from the Surrey farm. In Camberwell there was a similar incidence of scarlet fever upon the milk-drinkers that was found in St. Giles' and St. Pancras, while, as further evidence that the milk was infectious on leaving the farm, it was found that among the families of six railway servants who

received some portion of the milk at Charing Cross, thirteen persons were attacked by scarlet fever or throat affections, about the same time as the milk-drinkers in the other parts of London referred to.

Inquiry at the farm, however, proved that "it was practically out of the question that the milk at the farm had become infected in any of the commonly believed ways that required a human subject as the source of infection." Here then is another instance of disease starting from milk, but giving no sign of how the milk became infected. It is not our intention to trespass too much upon theories which must necessarily be speculative; but we would desire to refer in the briefest way, to a matter which may in the future, throw light upon this and other epidemics. Amongst the cows supplying milk on this farm, Mr. Power observed that one of them had recently calved. This was practically all, but the observation has led to certain experiments being performed by Dr. Klein, which tend to prove that if a cow which has recently calved is inoculated with matter taken from the throat of a person suffering from scarlet fever, she is affected by an ailment "which is transmissible, after the manner of an acute specific disease, to pigs."

Whether the cow without such inoculation can suffer from scarlet fever, the future alone can show; but in view of the possibility of her inoculation at this period, it is certainly important that her milk at such time should not be used for human food.

The story of diphtheria spread by milk in many respect resembles that of scarlet fever; in two or three outbreaks has been very clearly proved that the disease was di seminated by milk. Our lesson may be best learnt from c occurring in 1878, when over 200 persons were attacke North London; the epidemic was also investigated b Power, who showed first that the milk was the mea the communication of the disease, and secondly, that was very strong reason for believing that the milk h been infected after leaving the cow.

More recently an epidemic prevalence of sore throat at Dover has been attributed by Dr. Robinson to a milk supply coming from a dairy, receiving milk from three farms, in one of which the animals had recently suffered from foot and mouth disease.

Milk, then, may perhaps be a means of communicating not only the ailments of man to man but also of cow to man, and in laying down rules for their prevention, we must have regard to this fact.

DISEASES WHICH SPREAD BY AIR, BY CONTACT, OR BY INFECTED ARTICLES.

But while we have mentioned one method by which scarlet fever and diphtheria are conveyed to man, we have yet to tell of others which are doubtless far more common. Such are infection by direct contact with the patient, or at a distance by means of air poisoned by emanations given off by the breath or from the skin, or by infection of linen or articles of clothing, by mucous discharges from the nares and throat. One or other of these methods is the ordinary channel of communication of all the remaining infectious diseases, viz., typhus fever, measles, rötheln, mumps, relapsing fever, whooping cough, chicken-pox and small-pox. None of these affections are known to be communicated through the excreta or food, but only by contact with the sufferer, or by infected air, or infected articles.

It is a common experience to us all to find diseases spreading in this way. If any person is attacked with one of these affections, he is liable to infect first of all those who are in attendance upon him; he will give infection also to the bed in which he lies, to the curtains, the carpet, and also to the room in which he dwells; so that those susceptible persons who may come in contact with these articles or enter the room may themselves become victims to his disease. Or further, he may so infect the air of his apartment that it may escape from the room, and

thus carry disease to those who have never entered it. He is, indeed, during his illness constantly sowing seeds which have but to find a suitable soil in a susceptible person for their development.

When we contemplate what must be taking place as the result of every case of infectious disease, it is indeed a matter for surprise that these diseases do not spread more rapidly than experience teaches us they do.

Infection, then, may be conveyed from the sick to the healthy by persons who do not themselves suffer from disease; the carriage of infection by third persons is a possibility which has to be considered. A nurse in a fever hospital known to the writer, was a melancholy instance of this power of carrying infection. The hospital wards were at the time to which we refer occupied by numerous cases of typhus fever, and this nurse's exposure to the infection was of a most intimate character. She had long before suffered from typhus herself, and was not therefore susceptible again to its influence, and she felt that she might with safety to others spend a short holiday with friends in the country. Her story, as told by herself, is that she was careful to change her clothing, and take such other precautions as she thought to be necessary, but there is no doubt that she took to a farmhouse situated in a remote rural district her box and clothing which had been in the fever hospital. Shortly after her arrival several of the inmates of the house sickened with an illness which soon proved to be the sam fever she had been nursing at the hospital, with the resu that two of the sons of her host died. So the writer ha known small-pox and chicken-pox, and scarlet fever an measles, to be conveyed from one ward to another i hospitals.

Articles of clothing when once infected may retain t infection for a long period; often the removal to hospita an infectious person is rendered of no avail owing to fact that some infected garment has escaped observat and has been put away until some occasion for its has led to the re-appearance of the disease. For insta

the writer recollects a child being removed to hospital with a view to preventing his brothers and sisters contracting scarlet fever from which he was suffering; considerable care was taken to prevent him, on leaving, from taking away anything he had had during his illness. Some time after this, during the removal of the family into another house, his mother noticed a toy, which had been in his possession while ill, in the hands of a younger brother who had until then escaped. Within a few days this child sickened with the same disease and shortly afterwards died. The toy must have retained for a long period the infection, which had only awaited its opportunity for the production of a fatal disease.

Other instances are on record, that scarlet fever poison may thus remain dormant for more than a year without losing its power.

Writing of diphtheria, Dr. Thorne refers to instances which came under his own notice, in which the facts warranted the conclusion that the poison of diphtheria had been retained for months about premises in which cases of this disease had previously occurred.

These cases need not excite our surprise when we recall to mind the story told of wheat taken from the coffin of a mummy, where it had been placed some thousand years before, and which was yet found capable of propagation after all this lapse of time.

But at what period of the disease does the sufferer first become capable of imparting infection? We have said that from the moment the poison is received until the appearance of the first symptoms, there is an interval of time or period of incubation in each of these affections. There is much reason for believing that during this period the poison is not given off. This is best shown when a child ill with measles is accidentally admitted into a hospital ward where are other children who have not previously had the disease. If he remain there only for a few hours, he will likely enough have infected some number of those in the ward with him; his disease is then recognized and

he is removed to a place where he can do no further harm, but those whom he has infected will in their turn some eight or ten days later develop symptoms of the disease, and become a source of danger to others in the ward. Again in their turn these will be removed as soon as the disease is recognized, but not before they have imparted infection to some proportion of the remaining children, who will not sicken till about the same period has elapsed.

Now if the first group of children had been giving off infection while they were incubating the disease, we should not have had a second group attacked almost simultaneously eight or ten days after the first group sickened, but should have found the second series occurring at irregular intervals over the whole of the preceding period. Later on, this marked evidence of the incubation period gradually becomes lost, owing to the period not being absolutely fixed, and owing also to the non-removal of the children the very moment they sicken.

The writer has had the opportunity of witnessing this behaviour of the infectious diseases in the case of three separate affections, chicken-pox, measles, and small-pox, and there can be but little doubt that the other affections resemble those for which this fact has been observed.

We may take it, then, for all practical purposes, that the power of imparting infection begins with the first symptoms and lasts until the patient has absolutely recovered, and by recovery we must mean not only that he shall feel well, but that we shall not deem him recovered until all those special appearances of his disease shall have disappeared, which we shall presently describe.

These two periods have such important bearings upon the prevention of infectious diseases, that it will be well tc arrange them in a tabular form so that they may be bette understood.

There is much difficulty in learning the exact incubatic period of disease, owing to the comparatively few opp tunities which occur for eliminating extraneous sources

infection. For instance, a child may develop scarlet fever, and it may be known that some time before she was in contact with another child living in a house where scarlet fever was present. Are we to assume that this meeting was the cause? We could only do so with certainty if it were possible entirely to exclude all other chances of exposure to infection. In large towns, where there are always a number of persons suffering from this malady, it is impossible to be sure that infection has not been encountered at some large gathering, such as at school or at church, in the train or omnibus, or that infection has not been received in some other of the ways already indicated. We have to seek our most reliable evidence in sparsely populated districts, where the condition of health of every one can be accurately ascertained. The same difficulties meet us in our efforts to determine the length of time during which persons suffering from the various infectious diseases remain a source of danger to others, but it is believed that the statements contained in the following table are approximately correct. It must, however, be recollected that the duration of infectiousness varies much in different cases.

TABLE I.

Name of Disease.	Usual Period of Incubation.	Average Duration of Infectiousness.
Cholera . . .	1 to 5 days.	2 or 3 weeks.
Enteric fever .	8 „ 14 „	6 „
Scarlet fever .	1 „ 6 „	6 „
Diphtheria . .	1 „ 8 „	6 „
Typhus fever .	6 „ 14 „	4 „
Measles . . .	8 „ 20 „	4 „
Rötheln . . .	6 „ 14 „	3 „
Mumps . . .	14 „ 22 „	3 „
Relapsing fever .	2 „ 16 „	4 „
Whooping-cough	4 „ 14 „	8 „
Chicken-pox . .	10 „ 14 „	3 „
Small-pox . .	12 days.	6 „

The use to which we must put our knowledge we reserve for another chapter, but we must not omit to point out

here that these diseases are not all equally infectious at their beginning; that measles is undoubtedly infectious, and in a high degree, before the appearance of the rash, and before therefore the malady can be recognized, while scarlet fever is less infectious in the early stage, and the earlier appearance of the eruption enables it to be identified before it has always had time to do mischief; that whereas a brief exposure to measles, small-pox, chicken-pox, scarlet fever, and mumps, will often suffice for the communication of the disease, as a rule typhus is not contracted until the recipient of the poison has been exposed to it for a longer period. There are of course many exceptions to this rule. The writer has known a medical man to be daily engaged for some six weeks in attendance upon over a hundred persons suffering from scarlet fever, in different stages of the disease, before contracting it himself; and has, on the other hand, known a group of three nurses to contract typhus fever after but a day or two's exposure to a single case.

CHAPTER III.

MEANS OF PREVENTING COMMUNICATION OF INFECTIOUS DISEASE.

HAVING made ourselves acquainted with the manner in which infectious diseases are communicated to man, we must give our attention to the ways in which this communication may be prevented.

From what has already been said, it will be sufficiently obvious that no single rule can be made for all affections, for while some have one method of attacking man, others have another, and our means of prevention must therefore have relation to the method of attack. Broadly speaking, all are dependent upon want of cleanliness, or, to be more exact, upon "the presence of matter in the wrong place," for the dirt with which we have to deal is not mere débris of lifeless matter, but contains a vital organism. There is no doubt that the waste material of the body even in health is itself a ready source of disease, but of a kind with which it is not our business to concern ourselves. The matter which may cause infectious disease is its companion rather than its result, for where the one is found there may the other be also; not depending upon it for its first presence, although perhaps under some circumstances developing readily in it. The dust which hangs about the house may have with it the germs of scarlet fever; the dirt which soils the linen may contain the poison of enteric fever; and again, the filth that fills the cesspool may not only receive the poison of the same disease, but may provide for its growth and increase. The enforcement of cleanliness is, therefore, the prevention of disease, and especially of some of those diseases whose poisons may grow outside the body. These, from the fact that they are discharged from the body with

the excreta, are more closely associated with uncleanliness, and are indeed known, with others, as filth diseases.

While, therefore, we may hope, in our association with our fellows, by care to avoid some of the infectious diseases, for others, enteric and cholera, special precautions will be required, and these are means for the enforcement of cleanliness.

For the prevention of these affections the doctrine of cleanliness cannot be too earnestly preached. The pollution of houses, the saturation of the ground, the contamination of the air and water which result from habits of slovenliness and ignorance, are daily causing the deaths of numbers of persons. Every circumstance which gives opportunity for the pollution of air, earth, and water is fraught with danger to mankind. Within the house the fittings of water-closets and drains must be so arranged as to render this impossible, and beyond the house the same precautions must be taken ; thus, while we condemn the defective drain, which permits its contents, both gaseous and fluid, to escape beneath the house, so we must equally condemn the faulty sewer which leads to the retention of filth within it, and the cesspool, which is simply an opportunity for the preservation of the material upon the destruction of which our safety depends. Under no circumstances can the cesspool be defended. By this system we are absolutely surrounding ourselves with storages of poison, which may at any time deprive us of life ; for the air we breathe may thus become laden with the fatal poison, and we are exposing to the chances of contamination the water upon which our lives also depend. In some way or another the water we drink comes from the earth, and if the poison is stored beneath the surface, it will undoubtedly at some time find its way into the well or the stream.

Just as at Theydon Bois, cholera destroyed three-quarters of a household, and as at Bangor, more recently, enteric fever infected the whole district, so we shall always have disease and death amongst us so long as we expose our drinking water to excremental pollution. Nor is there any

need for the risks which are daily incurred by a large number of the population, for the means of safely disposing of the waste material of life are within the reach of all.

It would be beyond our province to enter in detail into the various modes of dealing with excremental matter, but we may briefly touch upon those requirements of health which must be held in view if we are to escape disease.

Wherever there is a water-carriage system we are exposed to danger from the sewer, for it must necessarily at times, through its communication with a number of houses, receive poisonous material giving off emanations which, carried into other houses, would expose the inmates to risk. The drain of the house must therefore be aërially disconnected from the sewer. This can be effected by the use of proper water-traps at both ends of the drain, at its entrance to the sewer and below each opening in the house. These will, if the sewer be ventilated so as to prevent any undue pressure within it, effectually guard against the admission of air from the sewer into the house. But this is not quite all; the presence of a closed cavity, such as the drain then becomes, may itself be a source of danger, for not only will the air of this cavity become charged with emanations from effete matter constantly passing through it, but the reception of hot water into it will so expand its air-contents as to cause them to pass through the traps and enter the house. This air-space then must be ventilated, and this is best done by the continuance above the roof of the soil pipe. Still even with this arrangement all our difficulties are not overcome, for the air in the drain will practically remain unchanged and will gradually charge the water in the traps, which in turn by evaporation from its surface, or by the bursting of bubbles, may discharge into the air of the house the poison which it contains. It is therefore necessary not only that the water in the traps should be changed by flushing, but that its pollution should be rendered impossible by the maintenance of a current of fresh air through the drain, and this can only be effected by the provision of another

ventilating opening at its lower part, before it enters the sewer.

In this manner we may protect our houses from the admission through the drainage of infection from without.

If there be no water-carriage system, recourse must be had to a dry method for disposal of the excreta. Receptacles sunk beneath the earth should be avoided, seeing that pollution of the ground is more likely to take place with such an arrangement than with others. The object to be held in view is the temporary deposit of the excreta in such a place and in such a manner that they may not give rise to any emanation which may enter the dwelling, and may be speedily and regularly removed therefrom. The receptacle, therefore, should be placed away from dwelling rooms and well provided with ventilation into the external air; and, to give facilities for the frequent removal of the contents, should itself be movable and of small size. The pail system is that which best meets the requirements of health, and where earth can be used in connection with the pail, the best results are obtained. Upon the subsequent disposal of the pail contents we need not enter, except to insist that whether this be done by a town authority or by the householder the same precautions shall be taken. Excreta may be manufactured into manure or used over land for the same purpose, but no storage must be permitted where it becomes possible for injury to health to ensue.

We have still to face the risk that some member of the household may contract disease elsewhere and develop it at home. What precautions must then be taken to prevent its extension?

To prevent the spread of infectious diseases we must rely in the first place upon *isolation and disinfection;* and by isolation we mean the separation of the sick from the healthy, so long as the former is capable of imparting his disease. If isolation is to be of the greatest value it must occur before the sufferer has already infected others. We have already stated that the infectious diseases are not equally communicable during their whole period, and that

they are not alike infectious in the earlier stage; thus, there is a greater probability that some diseases will have been communicated to other people by the time the disease is recognized, than is the case with the rest. Let us first consider the case of measles, which is so highly infectious in its early stage, even before the eruption makes its appearance, that in all probability if the sufferer have been in close contact with other children, the latter have become infected before isolation can take place. In considering then what shall be done if infectious disease appear in a family, thought must be had for the isolation not only of the individual who is already attacked, but of those who may be incubating the disease, and particularly when the disease is, like measles, very infectious in its early stage. This is of especial importance when the question comes to be decided whether the sick shall be sent away from the healthy or the healthy from the sick, for if the latter, although showing no signs at the time, are already infected, they may by their removal to another place, become fresh centres for the distribution of disease. Taking as our example of an affection very infectious in its early stage, the disease to which we have referred, and supposing one member of a young family were attacked with measles, which would obviously only come to be recognized as measles on the appearance of the rash, should we be acting wisely in recommending the distribution to one or more other places of the remaining children who will have had such contact with the sufferer as must always take place where a few children, who are brothers and sisters, live together in the same house? The question can only be answered if regard be had to other considerations; if the other children could be removed to a home where they may subsequently develop the disease without exposing fresh children to risk of infection, there can be no objection to such removal taking place, although no great promise can be held out that good will result from such a course. The convenience of the family in making arrangements must therefore be studied. But the alternative plan will

suggest itself of removing the sufferer to some place where he can do no harm: is this a better course? Here again, the same possibility must be held in view: the mischief is probably done before the removal can take place, and the suggestion should therefore be only acted upon when this is thoroughly appreciated. Speaking generally, if isolation from those already exposed to measles is to be attempted, it is not worth while that it should not go beyond an effort to retain the sufferer in a room apart from the other members of the family, with such other precautions as will afterwards be described.

With mumps and whooping-cough the facts are very similar. We have no rash to wait for here, and in the latter the bad cough from which the child is suffering rarely comes to be recognised as whooping-cough before the other children have become its victims.

But having said this much, we would wish to point out very clearly that the separation of persons who have not been exposed to infection of these ailments from those who are suffering from them, stands in very different relation to the separation of those who have already been exposed, and all proper precautions should be taken to prevent contact between healthy, susceptible persons and those who are infectious, from whichever of these diseases they may be suffering.

While we have dwelt upon the drawbacks attendant upon the isolation of persons suffering from diseases such as measles, whooping-cough, and mumps, which are infectious at an early period, we would wish particularly to distinguish between these and other affections less communicable at this stage. Innumerable instances could be given of one member of a family being attacked with typhus fever, scarlet fever, and diphtheria, whose removal from the house was the means of ensuring the safety of the rest of the household. If on the first appearance of the characteristic symptoms of these affections the sufferer is at once isolated, there is every reason to hope that the further extension of the disease will be prevented.

Between these two groups come the other diseases: these are undoubtedly infectious at the beginning of illness, although less so than measles.

The most complete isolation is accomplished by the removal of the sick to a hospital, and this is essential where the disease is of a character likely to endanger life, and especially where more than one family occupy the same house. Chicken-pox, rötheln, and mumps are affections so little dangerous to life that isolation is more a question of convenience than of necessity, but for graver diseases the need is much more urgent, and complete isolation should be rigidly enforced.

If removal to hospital be impossible, it is necessary to isolate the sufferer as completely as possible at home. He should be placed in a room at the top of the house, unless equally well isolated rooms can be found elsewhere, and be confined to the one or two apartments he is to occupy during his illness. The Society of Medical Officers of Health have recommended that a sheet soaked in a proper disinfectant should be hung over the door of the room, with a view to preventing the passage of infected air into other parts of the house. The windows both of the sick-room and adjoining passage should be kept open, so as to ensure thorough ventilation. From the room itself should be removed all unnecessary furniture, as well as curtains and carpets, unless it be proposed to destroy these at the end of the illness. If chests of drawers and cupboards are retained, they should be emptied of their contents, nothing being kept except what will be required by the patient. The carpet on the passage and stairs leading from the sick-room should also be removed, so that it may not be exposed to infection. The attendants should be selected from those who have previously passed through an attack of the disease they are called upon to nurse, and who are thus less liable to contract it again. They should be prevented from coming in contact with those who are not already protected, and the room they occupy must be avoided by

such persons. It would be well for their dress to be made of some material which can be readily washed and disinfected, and should not, therefore, consist of woollen material. The clothes worn in the sick-room must be regarded as infectious, as undoubtedly they become so through contact with the patient, and the attendants should therefore, before mixing with others, have the opportunity of changing everything and thoroughly washing in some room apart from that occupied by the infectious person. The same precautions must be taken with regard to the food supplied, the articles used, and the linen soiled in the sick-room. The strictest cleanliness must be enjoined upon the attendants; let them never place their hands to their mouths or touch articles of food until after careful and thorough washing; let the dejecta be received into a bed-pan containing a suitable disinfectant, at once covered, and immediately removed and disposed of; let the bed-pan and the pan of the water-closet be thoroughly cleansed, and the latter efficiently flushed. The same care should extend to all articles which come in contact with the patient, and which should be kept for his use alone. Soiled linen must be at once removed and placed in a pail or tank containing disinfecting fluid, and subsequently boiled and washed apart from other linen.

The length of time the invalid is thus kept in quarantine can only be decided in each individual case, but in the table already given will be found the average length of time which is required for this purpose. With regard, however, to two diseases, scarlet fever and small-pox, quarantine should be maintained until the shedding of skin in the former disease and of all scabs in the latter, has ceased. At the conclusion of the illness great care should be taken to cleanse the body and hair with frequent baths. After the last bath, fresh clothes should be worn, which have not been brought into the sick-room during any part of the illness. Thus purified, the prisoner may be set at liberty, although, if it be possible, it would be well for

another week or two to avoid close contact with those who are known to be susceptible to the disease.

The next step is to render innocuous the room which has been occupied — the bed, bedding, furniture and clothes which have been used by the infectious person, care being taken to include garments worn even some days before the illness.

But before concluding this branch of our subject, we would desire to urge the destruction by fire of all articles which are of no great value, so as to reduce to a minimum any risk which may occur from inefficient disinfection, since for all that is left we must entirely depend for safety upon those chemical processes the consideration of which we must leave to a later chapter.

We have as yet not touched upon what the householder may do to prevent the admission of disease by means of milk. Our knowledge of the circumstances under which milk becomes infected is too vague for us to rely with too much confidence upon such precautions as we are able to take to prevent its infection, but we shall only be following the dictates of common sense if we entirely prohibit the use as food for man of the milk of any cow which has recently calved, or of any animal which is not in perfect health. We must carefully guard the milk pail from pollution with water which is not altogether free from impurity, particularly from matter of excremental origin; and further, from risk of infection by proximity to any person who is suffering or has recently suffered from any of the infectious diseases. But when we have done all this we cannot be sure that our milk supply is a safe one; there is indeed but one way in which the milk consumer can hope to ensure this. It has been noticed during more than one epidemic due to an infected milk supply that those who boiled their milk before drinking it escaped disease, while those who drank it unboiled suffered. This was observed quite recently in the outbreak of enteric fever in St. Pancras to which reference has been made; in one house lived two children, both of whom received milk from the

same source, but the one was considered a more delicate child than the other, and it was thought well for this reason that it should not drink milk that had not been cooked. Of the two children the child drinking the boiled milk escaped disease, while the other passed through an attack of enteric fever. The habit of boiling milk before using it for food is one which is far more common on the Continent than in England, but it is a custom we should do well to adopt. We know that raw ham will under certain circumstances produce a fatal disease amongst those who eat it, a disease from which English people are no doubt preserved from their custom of always cooking it before consumption. If they could learn to recognise the wisdom of always cooking milk with the same regularity as they do meat, much of the disease conveyed by this means would be prevented.

By the means we have described we may hope very considerably to reduce the prevalence of certain diseases amongst us; those which are dependent upon filth conditions, such as cholera and enteric fever, might be practically eliminated from our death returns; scarlet fever and diphtheria would be lessened if we could, by care of our food supplies, cut off one of the channels by which they are conveyed. But there would be still many opportunities for these and other infectious diseases to be communicated, and we shall therefore be glad to learn some further means by which disease can be escaped.

CHAPTER IV.

MEANS OF PRODUCING INSUSCEPTIBILITY TO INFECTIOUS DISEASE.

THUS far our efforts have been directed to showing how we may escape exposure to infection, and it will be seen that we have been obliged to rely upon methods which are at the best not always infallible.

It was no wonder, then, that other methods than those we have described have been sought for, methods which aim less at avoiding infection than at rendering the body proof against its invasion.

If we cannot prevent the seed being air-borne into our meadow, may we not endeavour so to influence the soil that the seed may find no material upon which it can exist? We know that if the disease has been suffered once it is only rarely that it will find for itself food-material a second time in the same person.

It was with this knowledge that in the last century attention was directed to finding some way, different from that which nature provides, by which man could pass through a less fatal attack of an often fatal disease, and live protected against its influence afterwards. It was a century and a half ago that Lady Mary Wortley Montague introduced into England the custom of inoculation for small-pox.

When small-pox is contracted in the natural way, a period of twelve days elapses between the time of reception of the poison and the time when the first symptoms appear, and a period of fourteen days before a general eruption breaks out over the body. When small-pox is inoculated, the course of the disease is different. On the day after inoculation a small papule or elevation shows itself at the place where the puncture is made, and on the tenth or eleventh day a general rash breaks out over the body.

The course of the disease is, it will be seen, hastened when the virus is inoculated; and further, the affection is usually of a milder type than when contracted in the ordinary way. While this method had the advantage of reducing mortality, it was unsatisfactory for more reasons than one. In the first instance, it was attended by some loss of life, and secondly, whoever was inoculated was a source of danger to other susceptible people during his whole illness. But people in former days were but too glad to find any way of mitigating the severity of this dire disease, and this method was therefore practised until Jenner's great discovery, in 1798, led to the introduction of vaccination, and rendered inoculation unnecessary.

Jenner observed that the milkers of cows were not attacked with small-pox, a fact which attracted much attention at a time when to escape from small-pox was a comparatively rare event. He further observed that these people contracted an affection from the cow which could be communicated by inoculation from one individual to another, and that protection from small-pox was enjoyed by those who were thus inoculated. It has remained for future generations to understand more thoroughly how this protection is brought about. In the time of Jenner, cow-pox, the disease communicated from cow to man, was of much more constant occurrence in the cow than at the present time. Now it is a rare event for cow-pox to be found. What, then, has happened to prevent the appearance of this affection amongst these animals? To answer this question let us think for a moment of certain points in the behaviour of the disease; first, it occurs only in the female animal, that is, the animal with which man comes most in contact; secondly, the disease appeared on the teats and udder alone, the very parts of the animal constantly exposed to human touch. A moment's thought leads to the conclusion that man must in some way or other be the means of communication of cow-pox to the cow. But whence comes the disease which is thus conveyed?

Before the introduction of vaccination, it was, as we have

said, the exception for any one to escape small-pox, just as in our time it is the exception for individuals to suffer from this disease; supposing, therefore, that man, while suffering from small-pox, in the act of milking inoculated the cow, his opportunity for doing so at the present time would be enormously reduced. Thus we can understand, that if cow-pox in the lower animal depends for its origin upon small-pox in man, it would necessarily be more seldom found in the present day. There is, indeed, but little doubt but that cow-pox results through the inoculation of the cow with the small-pox of man, and that the passage of the virus through the lower animal so modifies it that it can be again introduced into man, producing an affection sufficiently like small-pox to protect from an attack of this disease, without being attended by risk to life or by any power of communicating itself except by the process of inoculation.

The circumstances under which the cow can be thus inoculated with small-pox matter are not well understood, and the operation is very difficult of performance. Many have tried unsuccessfully again and again, others have succeeded by inoculation of the cow with small-pox matter in producing small elevations or papules which have again given rise to small-pox in man when the fluid they contain was introduced into his system. It is, however, very difficult in the laboratory to exactly imitate nature, seeing that we do not know what the conditions are under which the cow could contract this disease.

However much we may speculate on the question as to how such inoculation may be performed, there is no doubt that it has been accomplished by a few individuals, and the success of the few is of infinitely more importance so far as proof is concerned, than the failure of the many. As a result of what is known of cow-pox in the cow, we have but little hesitation in accepting as probable in a high degree that vaccine lymph is really small-pox modified by being passed through the cow.

Vaccination, indeed, resembles inoculated small-pox with

three important exceptions; ***the general eruption of small-pox does not occur, the affection is not communicable from person to person except by inoculation, and does not endanger life.***

We thus come to see how vaccination or small-pox modified by transmission through the cow, is capable of protecting against small-pox. As yet the same method of protection is not available for the other infectious diseases to which we are liable, but for some animals, more fortunate than man in this respect, a similar discovery has been made. Every one has read of the terrible destruction of sheep and oxen abroad by the disease which is known as anthrax, an affection which is communicated from animal to animal with but too much readiness, leading to the growth of an organism in the blood and internal organs, which in a very few days causes the death of the creature. So fatal has this disease been that many efforts have been made to arrest its course, and at last M. Pasteur has succeeded in growing outside the body the poison which causes the affection, and has, by cultivating it in an appropriate fluid, produced an organism which, when inoculated into sheep, causes an affection which does not as a rule end fatally, but which protects the animal against subsequent attacks of the same disease.

In 1883 there was an outbreak of disease among cattle in the Argentine Republic so destructive that Dr. Roy, of the Brown Institution, was sent to investigate its nature. Finding this disease to be anthrax, Dr. Roy proceeded to seek a means of protecting the herds against this destructive malady. He was fortunate in discovering that the prairie dog, a rodent, could itself be inoculated with anthrax, and that if the spleen were taken from such an animal which had died from this disease, and the virus which it contained used for the inoculation of cattle, a mild and non-fatal attack of anthrax resulted, which protected them against subsequent attack. Thus the passage of the virulent anthrax poison through the body of a rodent so altered its character that it could be used for the inocu-

lation of cattle just in the same way as the passage of virulent small-pox poison through the cow so alters its character that it can with safety be used for the inoculation, *i.e.*, the vaccination, of man.

This then is the method which has already since Jenner's time been the means of saving many millions of lives from small-pox, and which might save many more were the value of the operation and the proper mode of its performance, better understood.

At the present moment, while continued efforts are being made to mislead the public as to the value of vaccination, it will not be out of place if we consider very briefly how much vaccination has done for us, and how much it might do if its value were more generally recognized. First, let us point out that small-pox is not one of those diseases which are known to be spread through the excreta, or through milk; we cannot therefore hope by improved methods of drainage, or by care for the protection of our milk supply, to lessen this disease among us. Just as we are liable to contract measles and whooping-cough whenever we may become exposed to its infection, so we are *naturally* equally liable to suffer from small-pox. There are probably not very many people who attain adult life without having passed through measles, so before vaccination was introduced there were not many people who in early life escaped small-pox. Wherever we turn the records of past times tell the same story. In the tenth century, Rhazes, a Persian physician, begins a book by inquiring "Why do we seldom find one or two people out of twenty who have not suffered from small-pox?" In the last century, Süszmilch, who was working at statistics concerning population, stated that a twelfth of the total deaths were due to small-pox. And again, Dr. Storch, who died at Eisenach in 1751, says that "from love or small-pox few people were exempt." The behaviour of small-pox in the last century in our own country is especially instructive. Dr. J. C. McVail, of Kilmarnock, has recently shown what small-pox did in that town. In the beginning of the year 1728 the schoolmaster

of Kilmarnock began to keep a register of mortality for his parish, from which Dr. McVail has elicited the following information. First, that death from small-pox was much limited to children under five years of age, and almost entirely to children under ten years of age. Every four years came an epidemic attacking nearly all the susceptible people in the district, killing many and protecting the majority of the remainder against subsequent attack. The chances of any susceptible person escaping two epidemics was so remote that not half a dozen deaths occurred after ten years of age. All that could die, died before this age. But of those below five years of age, how many died? Of every 1000 born, 116 were killed by small-pox before attaining this period of life. So regular were the epidemics in making their appearance, and so fatal the disease that Dr. McVail, writing of Kilmarnock in that time, says that "as regards small-pox there were in fact three Kilmarnocks. One, a Kilmarnock of 3700 persons, had no fear of its attacks. These had already met with and battled with the disease-fiend. On many were to be seen the marks of the conflict. Some were blind, some had lost their hearing, many were permanently injured in constitution, and very many were scarred and disfigured for life; and for every one that had conquered another had fallen never to rise again. There was indeed a second Kilmarnock under the green sod of the kirk-yard. The Kilmarnock which had reason to dread the epidemic's approach was the Kilmarnock least able to meet it. It consisted of a little band of children, numbering less than five hundred in all. Every such group that came into existence had to face, within four or five years of birth, the most terrible physical enemy that it would ever meet, and having fought the battle, some were added to the maimed and distorted who formed so large a portion of the population, and others were laid beside those who had been destroyed by former epidemics."

Small-pox, then, behaved in Kilmarnock much as measles does amongst us now, except that while measles comparatively rarely kills, small-pox killed or disfigured a large

proportion of its victims. But the story of Kilmarnock is doubtless true for other towns as well. In an old record of the town of Chester, in the possession of Professor Paget, of Cambridge, we find that in the year 1774, of a population of 14,713 persons, 546 died from disease, of whom 202 lost their lives from "natural small-pox"; and again, it should be noted that the 202 deaths were entirely confined to children under ten years of age, and all but twenty-two to children under five years. A survey or census of the town of Chester in that year, showed that of the 14,713 inhabitants but 1060 had never had the small-pox, or 1 in 14; the old record stating that "one-eighth part of mankind die of the natural small-pox."

How different from the behaviour of small-pox in our time, when it is the exception and not the rule to have this disease, when scarred faces are comparatively seldom seen, and when instead of *an eighth*, not *one-hundredth* of mankind die from its effects. It is not, however, by all people equally that this reduction of liability to death from small-pox is enjoyed. An examination into the comparative small-pox death rates among vaccinated and unvaccinated persons shows this conclusively. For this we may refer to the memorandum of Dr. Buchanan, medical officer of the Local Government Board, on small-pox in London, in the year ending May 29, 1881, and which can be best understood from the following Table, which we extract from the Parliamentary return :—

COMPARATIVE SMALL-POX DEATH-RATES AMONG LONDONERS, VACCINATED AND UNVACCINATED RESPECTIVELY, FOR THE FIFTY-TWO WEEKS ENDED MAY 29, 1881 :—

Death-Rate of People of subjoined Ages.	Per Million of each Age of the Vaccinated Class.	Per Million of each Age of the Unvaccinated Class.
All ages	90	3,350
Under 20 years . . .	61	4,520
Under 5 years . . .	40½	5,950

Or again, let us learn from the same source the conclusions which are drawn from an analysis of the deaths from small-

pox occurring during 1881 in London amongst children under ten years of age. In this year among 55,000 children in London who had not been vaccinated, there were 782 deaths from small-pox; among the 861,000 children who had been vaccinated there were 125 deaths from small-pox. "If the London children under ten who were unvaccinated had had the protection which the current vaccination gives, not 782 of them, but at the outside *nine* would have died of small-pox during the year. If the 861,000 vaccinated children had died at the rate of the 55,000 unvaccinated, we should not now be considering 125 small-pox deaths, and how they can be reduced, but we should be confronted with an additional 12,000 and more deaths from small-pox, occurring during the year in the London population under ten years of age." *

A further proof of the value of vaccination as a means of protection against small-pox is to be found in the immunity enjoyed by attendants in the Small-pox Hospitals upon persons suffering from small-pox. At the London Small-pox Hospital at Highgate, where many thousands of people were treated, small-pox among the attendants was practically unknown, the only case in forty-eight years occurring in a man who refused to be revaccinated, and the same story is true of other institutions.

Dr. Collie says, "During the epidemic of 1871, 110 persons were engaged in the Homerton Fever Hospital in attendance upon the small-pox sick; all these, with two exceptions, were revaccinated, all but these exceptions escaped small-pox. The experience of the epidemic of 1876–77 was of the same kind; all revaccinated attendants having escaped, while the only one who had not been vaccinated took the disease and died of it. So in the epidemic of 1881, of ninety nurses and other attendants of the Atlas Hospital Ship (Small-pox), the only person who contracted small-pox was a housemaid who had not been

* Eleventh Annual Report of the Medical Officer to the Local Government Board, 1881–82.

revaccinated." If these people had all previously had small-pox, their escape would have been no matter for surprise; but in view of the fact that they had not so suffered, and that those who had not been revaccinated contracted small-pox, there is not the least doubt that the immunity of the remainder was the result of vaccination.

There is still another lesson to be learnt than that of the saving of life. It is that whereas in the last century death from small-pox was almost limited to early life, now it is the older persons who more particularly become its victims. How has this change been brought about? The story of Kilmarnock and the story of Chester make this perfectly clear. In the last century but few people, as already stated, attained adult life who had not in their early days passed through an attack of small-pox; now but comparatively few have thus suffered, or rather they have suffered in early infancy from that affection which we know as vaccination, but which there is so much reason for believing is small-pox modified by transmission through the cow.

Now future protection against disease is dependent upon the thoroughness with which the susceptibility of the individual is exhausted, and it is more than probable that vaccination in one or two places only does not protect for so long a time as small-pox does when contracted in the natural way.

We must then learn the following lesson: *The value of vaccination as a protection against small-pox depends upon the manner in which the vaccination is performed.*

It is possible by the introduction of vaccine lymph in one small place, to obtain complete protection against small-pox; but for a while only. If the protection is to last for a number of years, the vaccination should be in five, or in four places at the very least, and should be performed in such a manner, that the scars resulting should together have an area of at least one-half of a square inch.

Moreover, the amount of protection is dependent upon the vaccination running a natural course. The fact that

quantity and quality of vaccination are alike concerned in the matter of protection is undoubted, not only as affecting the prevention of disease, but, further, if the vaccinated person subsequently contracts small-pox, his chances of death or recovery depend upon both these conditions. The latter is well shown by the following Table, compiled by Dr. McCombie, of the Deptford Small-pox Hospital :—

Number and quality of vaccination marks.		Mortality in each 100 attacked with Small-pox.
One mark	Good	6·4
	Indifferent	16·7
Two marks	Good	3·7
	Indifferent	11·2
Three marks	Good	3·7
	Indifferent	7·4
Four marks	Good	2·7
	Indifferent	4·8

Or we may accept Dr. Collie's summing-up of the rates of mortality amongst persons suffering from small-pox, by saying that "the unvaccinated will die at the rate of about 50 per cent., the badly vaccinated at the rate of about 26 per cent., and the well-vaccinated at the rate of about 2·3 per cent." *

Upon properly performed vaccination we must, therefore, rely for protection against small-pox, and as we have said, that to be properly performed, the lymph should be inserted so as to produce at least four or five vesicles, and should be of a quality to produce vesicles which will run a natural course.

Wherever it is possible, and it is always possible in towns, vaccination should always be done *direct* from one child's arm to another, or from the calf to child, both being in the room at the same time. If lymph stored in tubes, or on ivory points be used, it is more likely to produce fewer and smaller vesicles than intended, and the individual may thus be insufficiently protected against small-pox. Nor can this misfortune be readily remedied, for, as already stated, the production of one vesicle will

* Quain's 'Dictionary of Medicine.'

render the individual altogether insusceptible for a time and nothing can be done until he again becomes susceptible to this affection. In all probability his susceptibility to attack from natural small-pox returns at the same time, and it is usually a mere chance as to whether he is again vaccinated before being exposed to infection.

If vaccination is performed in the best way in infancy, may we assume that we are proof against attack from small-pox for life? Experience has shown that we may not do so, for although vaccination in infancy will in most cases lessen the severity of small-pox during the whole period of existence, and thus largely save life, its full protection against attack from small-pox has a tendency gradually to diminish as time progresses, and every person should, therefore, on attaining the age of puberty be revaccinated, care being taken that when possible the vaccination is done direct from the child's arm or from the calf, and as thoroughly as in primary vaccination. As a general rule, this will be sufficiently early; but if the primary vaccination be badly performed, or if there be known exposure to infection, this period of life must not be waited for.

With properly performed vaccination and revaccination, small-pox would be practically abolished from the country. That revaccinated persons are protected against small-pox there is the strongest evidence—witness the protection of the nurses in the hospital already referred to.

In practice it will be sufficient if all persons are properly vaccinated in infancy and revaccinated at puberty. The number of cases of small-pox which occur after efficient revaccination is so infinitesimally small as not to be worth consideration.

We have already shown that inoculated small-pox runs a different course from small-pox acquired in the natural way, and that the eruption appears some days earlier; so we find that vaccination, which we have regarded as representing the local vesicle without the general eruption, runs a course resembling that of inoculated small-pox. This difference in time becomes of great importance when

it is desired to protect from disease those susceptible persons who may have already been exposed to infection. It is quite possible even after infection by small-pox, that such a person may still be protected by vaccination.

Vaccination, we have said, passes more rapidly through its various stages than does natural small-pox, and can, therefore, overtake the latter. Vaccination becomes protective when around the vesicle an areola, or ring of redness, has appeared, and this is to be found on the *ninth* day after the performance of the operation. In small-pox, *twelve* days elapse between exposure to infection and the development of the first symptoms, hence, vaccination gains three days upon small-pox, and if performed within the first three days of exposure to infection of small-pox, the latter disease will be prevented. For the knowledge of this fact we are indebted to the late Mr. Marson, who says, "Supposing an unvaccinated person to inhale the germ of variola (small-pox) on a Monday; if he be vaccinated as late as the following Wednesday, the vaccination will be in time to prevent small-pox being developed; if it be put off until Thursday, small-pox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use, it will not have had time to reach the stage of areola, the index of safety, before the illness of small-pox begins." *

Something then is to be done even at the last moment; but it is obvious that no wise person would wait until he had been exposed to infection before seeking so simple a means of preserving his life and health.

Nor are there any risks attending the operation which need be taken into account for any other reason than to ensure its proper performance. The inoculation of another disease cannot take place where proper care is exercised in the selection of lymph and in the mode of performance of the operation. The occurrence of erysipelas is the rarest event; with proper care during the vaccination

* Marson, art. "Small-pox," in Reynolds' 'System of Medicine.'

and afterwards, it need not be feared. There is, indeed, but one real risk in connection with vaccination, and one which should be especially borne in mind at the present time, viz., that in forgetting the terrors of natural small-pox, people may eventually cease to take this simple precaution for its prevention, and may only learn to appreciate the value of the remedy after a dearly bought experience.

CHAPTER V.

DISINFECTION.

If it could be ascertained whether the use of so-called disinfectants had done more harm or more good, it is probable that the balance would be found in favour of the former view. There is too much readiness to believe that the placing of one or another of these substances in a saucer in a sick-room, or that the sprinkling of another over infected garments, has an influence in preventing disease which may permit the use of the disinfectant to replace precautions of an important character. Thus the writer has frequently found that the separation of the sick from the healthy has not been regarded as necessary when a so-called disinfectant can be used, and that the sprinkling of the floor or the spraying of the air has been allowed to replace the most ordinary requirements of cleanliness.

While, however, it is easy to condemn methods which we know to be futile, it is not less difficult to point out any one method which can be regarded as conclusively satisfactory. There are few subjects on which we have less information than the means of destroying infection, and our ignorance is dependent upon the difficulties which stand in the way of testing the value of the various substances which may be useful for this purpose.

If it were possible to separate the poisons of the different infectious diseases, act upon them with some of these substances, and then introduce them into the bodies of susceptible people, we should soon be able to form a more distinct idea of the value of the disinfectant. This is in practice impossible, for apart from other reasons, there are but very few of the infectious diseases whose virus we

could thus deal with. Nature herself performs experiments but of too uncertain a character for us to draw any definite conclusions from them. If any person after exposure to a presumably disinfected garment should develop fever, and other possibilities of infection could be excluded, we might assume that the garment is responsible for the disease, and that the disinfection was worthless; but the difficulty remains that the method of performing the disinfection may be at fault, not that the disinfectant is itself to blame.

On the other hand, if the garment failed to infect, we could not assume that the disinfection was complete, seeing that we could not be sure in the first instance that the poison was introduced into the system, or that the person receiving it was susceptible to its influence.

It is therefore necessary that we should rely only upon definite experiment for the purpose of ascertaining which are the best disinfectants, and the best method of using them; such experiments have been performed by Dr. Buchanan Baxter in England, and by Drs. Koch, Wolfhügel, Gaffky, Löffler, Fischer, and Proskauer, in Germany. The materials used were anthrax virus, vaccine lymph, septic poison, fungi, &c., for it was thought, and no doubt correctly, that the organisms which were the cause of the different infectious diseases were likely to be affected in the same manner as those chosen for experiment.

Disinfection to be of service must be capable of destroying the whole of these organisms wherever they may be situated, as well as their spores, which are more tenacious of life.

The same disinfectant is not always selected under all circumstances; thus, that which is required for the purification of the air of an infected room is different from that upon which we must rely for the disinfection of clothes, or of bedding, or of the excreta. It is sometimes sufficient to render the virus temporarily inoperative, and the same disinfectant would not be employed for this purpose as for its destruction. It will therefore be well if we consider each of these conditions separately, and learn how we may best proceed to render innocuous the room occupied by, the

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clothes worn by, the bedding used by, and the discharges of, the infectious person.

First, we have to purify from infection the air, walls, ceiling, and floor of the room, as well as the furniture it contains; for this purpose sulphurous acid gas, which is produced by burning sulphur or bi-sulphide of carbon, has been most largely used, and is perhaps of some value. Recent experiments have, however, shown that where the organisms lie in a thick layer, or in any way not immediately on the surface, they are liable to escape from destruction; and again, if they are in the condition of spores they do not seem to be affected by this gas; thus the spores of anthrax were found by Dr. Koch to be unaffected after exposure to the gas for 96 hours, and subsequently, when inoculated into a mouse, speedily proved fatal.

The only reagents which may be really trusted for the fumigation of rooms are bromine, chlorine, and iodine; of these the first two are the most reliable. Drs. Fischer and Proskauer, experimenting with these reagents, found that to ensure success it was very necessary that the atmosphere of the room should be thoroughly moistened, and that a certain strength of the gases was essential; the greater the moisture within certain limits, the smaller the quantity of gas needed. Neither of these gases have any power of penetration, and may, therefore, only be trusted to disinfect surfaces. Bromine has certain disadvantages connected with its use, in being more destructive and more costly than chlorine, and it will be well, therefore, to rely upon the latter.

To begin with, the room should have its floor, doors and woodwork generally moistened with water, the fireplace and windows should be closed to prevent the escape of the fumes, and basins containing the disinfectant should be placed at different levels about the room, so as to ensure its even distribution. Each basin should contain chloride of lime into which a bottle containing hydrochloric (muriatic) acid should be so placed that its contents will gradually trickle out into the chloride of lime. The room should then

be rapidly vacated, for the fumes will become unbearable, and the door closed. Twenty-four hours should elapse before the door is again opened, the room should then be well ventilated and thoroughly cleaned; the paper should be stripped, the ceiling limewhited. The amount of disinfectant used must, of course, be in proportion to the size of the room. Drs. Fischer and Proskauer found that there must be six ounces of chloride of lime and ten ounces of hydrochloric acid for each cubic yard the room contains, which is roughly at a cost of nearly twopence a cubic yard.

Before leaving the subject of disinfection of rooms it will be well to point out the utter futility of attempting their disinfection, during occupation by the sick, by the use of other substances which are now so freely placed about rooms in saucers, and which for such a purpose are practically as valueless as the charms and philtres to which we have referred in our earlier pages.

For the disinfection of different articles we must trust to other reagents; and here again we must remember that the most recent knowledge has shown how little dependence can be placed upon the majority of substances which are now used. In the hands of Koch, the use of corrosive sublimate has been most successful. Experimenting with living organisms, he found that a solution of the strength of one part in five thousand was sufficient to destroy most organisms, while one part in a thousand * destroyed all. The solution had but to be painted over the surface of the infected article and allowed to remain there for half an hour to do all that was necessary; it could then be washed away and the article thoroughly cleansed. There is, however, one serious drawback to its use—its exceedingly poisonous properties; as small an amount as three grains has been known to kill a child, and but a little more is sufficient to cause the death of a man or woman. It is very inexpensive, and its poisonous properties are the only objection to its use, but the risk may be diminished

* Roughly one ounce of sublimate dissolved in six gallons of water.

by colouring the solution and adding some strong smelling substance, and keeping it (preferably in a concentrated solution) under lock and key, only placing it in the hands of others after dilution, and at the time of use. In face of this difficulty it is satisfactory to know that heat is an effectual means of destroying all organisms, and that most articles of clothing or of bedding can be exposed to the requisite temperature without injury. In a previous chapter we have referred to outbreaks of disease by infected milk, and have commented on the immunity enjoyed by those who only drank the milk after it had been boiled. We shall, therefore, not be surprised to find that the experiments of Drs. Koch, Gaffky, and Löffler on anthrax virus teach the same lesson, and show that even the spores are killed after two minutes' exposure to boiling. Now all small articles of clothing and linen both from the body and the bed, can be boiled, and there is therefore every reason for systematically carrying out so simple a process.

It is not so easy a matter to raise to a sufficient temperature the whole of a pillow, bed, or mattress, when exposed to a dry heat as, for instance, in an oven; it will take a number of hours before the heat penetrates the interior so as to raise a thermometer placed there to a temperature sufficient to destroy organisms. It would, therefore, not be wise to trust for the purposes of disinfection to such baking as may be done in an ordinary kitchen oven. The above experimenters found that a temperature of 140° Centigrade (284° Fahrenheit) for three hours was required to destroy the spores of anthrax, when dry heat was employed.

Fortunately, by means of "superheated steam," heat may be otherwise applied to those articles which cannot be boiled; this, however, cannot be done at home, for it requires a special apparatus. While by this method a temperature of not less than 100° Centigrade (212° Fahrenheit) is needed to destroy the spores of anthrax, a far less temperature than 140° will answer every purpose. Experiment has, indeed, shown that 105° is the maximum required.

For the penetration of a bed a period of three hours is

sufficient, and may be trusted to for the disinfection of any ordinary bed or bedding. When the article to be disinfected is of great thickness or of dense substance an interrupted application of the heat is useful in assisting the penetration of the steam. By this method the article to be disinfected exchanges the cold air it contains for the hot steam to which it is exposed, and the maximum heat in the interior is more rapidly attained. Steam has the further advantage of not damaging the articles disinfected to the same extent as hot air. Cotton and wool fibre stand exposure to it well, and feathers and horse-hair are not injured. Colours fade somewhat, becoming a lighter shade; leather only will not stand exposure to steam.

We have still to decide upon what is to be done in the sick room with infected linen and with the infectious excreta of the patient. Linen, we have seen, may be freed from infection by thorough boiling, but arrangements will have to be made for its safe disposal during the period that it awaits boiling, and this we would recommend should be as short a time as possible. It may during this interval be steeped in a solution of corrosive sublimate of the strength of one part in a thousand; if this fluid be objected to on account of its poisonous properties, it then becomes necessary to use some other re-agent, and this will necessitate our falling back upon one of a somewhat numerous class which, while they do not destroy permanent spores, are yet very useful in preventing their further development while in contact with the disinfectant. This class includes, amongst others, carbolic acid and thymol; to the first of these objection may be taken that its use in place of a solution of corrosive sublimate is merely substituting one poison for another; it is, however, in such general use that its poisonous qualities are universally recognised, and owing to its powerful odour the probability of accident occurring from its use is more limited. A solution of the strength of two parts in a hundred is sufficient to prevent the further development of organisms, but it will not, as has already been stated, destroy the spores of all

the poisons by which its value can be tested; in this proportion it is not destructive of linen. The second, thymol, is much more free from objection on the score of poisonous qualities than carbolic acid, and appears to answer as well in preventing further development of the spores. It may be used in a much more diluted form, one part in eighty thousand, in the hands of Koch, being found sufficient.

Either carbolic acid or thymol may be employed for moistening the sheet which it has been recommended should hang over the door of the sick room to prevent the egress of air, and may be placed in the bed-pans which receive the excreta of the patient; the flushing of water-closets and drains may also be performed with the same fluids.

But while we devote our attention to the destruction, and prevention of development, of infectious organisms, given off by the sick, we must above all things be careful to attend to the ordinary requirements of cleanliness, for we cannot assume that all emanations thus produced will come within the reach of our disinfectants. At the same time we must remember that the dilution of the infectious poison by air is a means of reducing its potency, and the sick room should therefore be freely ventilated, in the interests both of the sufferer and his attendants.

Again, both during and at the conclusion of his illness we should avail ourselves of natural disinfection; and by this we mean the action of sun and air. The exposure of bed and bedding to these influences appears to have some value, which makes us unwilling to omit mention of them here; they should not, however, be allowed to supersede the artificial disinfection which we believe to be necessary for the complete destruction of the infective poisons; but the probability that nature herself, though perhaps more slowly, accomplishes the same end by these means, makes us desire to utilize them to the utmost.

A room that has been disinfected should remain unoccupied for some days, and the windows should be left

constantly open, both day and night, to allow of the free action of the elements.

It will be convenient here to make some reference to the precautions which should be taken in the event of death from any of the infectious diseases.

In the preparation of the body for the grave, it should be recollected that it is still capable of infecting those who may come in close contact with it, and the same care must be exercised by those whose duty it is to perform for it the final offices. It should be washed with fluid containing one of the disinfectants mentioned above, and as soon as possible placed within the coffin, which should be at once closed. The removal of the body to another room should not be encouraged, seeing that such removal prevents the limitation of contagion to those parts of the house already infected. Burial should not be delayed; our thought must be for the living, and nothing but an unwise sentiment can make us wish to retain above the earth that which may be a further cause of death.

CHAPTER VI.

GENERAL PRECAUTIONS.

SO far we have devoted the space at our disposal to giving some account of the manner in which infectious diseases are caused and communicated, and of the means which are at the disposal of every individual to prevent the occurrence of such disease, and to limit its extension should it make its appearance in any dwelling.

In conclusion, let us dwell very briefly upon the precautions which we must take as communities with the same object. If any person suffer from one of the infectious diseases, his illness does not affect himself alone, but is a matter which concerns the community in which he lives. It concerns them in two ways; first, that the sufferer may be a source of danger to those about him, secondly, that the cause of his disease may be a cause of the same disease to other persons.

It is the duty of every person so suffering to submit to certain restrictions which must be placed upon him on behalf of the safety of other people. During the time that he is infectious he must not allow himself to associate with any but those who are required to minister to his wants, and he must thus remain in durance until he is informed by a competent authority that he is no longer a source of danger. There are many people who will willingly take these precautions, indeed, all right-minded persons would not hesitate to do so; there are others, again, less thoughtful, who will not subject their own convenience to the safety of others. It thus becomes necessary, in the interest of the community, that each case of disease should be made known to the official whose duty it is to protect the health of the number.

Such knowledge would not only serve to check the

carelessness of those who are ignorant of the harm they are doing, but would often enable the cause of disease to be discovered. Without such information, an infected water or an infected milk-supply may be carrying disease and death into many a home, and the existence of the outbreak so caused remain unknown until the poison has spent its force. If each case were at once made known, a careful officer would at once suspect from an increase in the number of cases that some new cause was in operation, and would ascertain whether the drinkers of a particular water, or of milk from a particular dairy, were suffering out of proportion to other persons, and thus a number of lives would come to be saved through the stoppage of the supply.

Every person should assist, both in his own interest and that of those among whom he dwells, in having every case of infectious disease properly investigated. Only by such means can its prevention seriously be undertaken.

Every community should insist upon the proper removal and disposal of all waste matter, whether excrementitious or of other kind, and pollution of the earth should be rendered impossible.

A sufficient and wholesome water supply should be provided, one which, under no circumstances, is liable to contamination.

While attention is devoted to water supply, other food supplies should not be forgotten. Dairy farms should be under constant medical supervision, to prevent outbreaks of infectious disease, and to ensure that the water which is used for feeding the cows or for washing the pails, is free from contamination. No milk should be taken from any but healthy cows, and this provision should exclude cows which have recently calved. No person engaged in attendance upon the cows, or in carrying the milk, should be permitted to continue his duties if he have any infectious disease himself, or if any person living in the same house with him, or with whom he be otherwise in contact, is suffering from such affection. Milk should be stored only

in those places where it is not exposed to contamination. It is known readily to absorb any matter which escapes into the air in its vicinity, and it should therefore be stored only in places specially prepared for its reception, which are kept scrupulously clean, and do not contain an inlet to any drain.

In the event of suspicion attaching to a milk supply, each milk-vendor should be prepared to supply all information as to his customers, and should so arrange his books that, should he draw his supplies from more than one farm, it would be possible at once to tell whether the drinkers of milk from one or another source were the sufferers.

The centres of communication between numbers of individuals should be carefully and constantly watched, every outbreak of disease should be subject to investigation, and if it be found that those who congregate at any one of these centres, are suffering more than others, inquiry should be made in this direction.

If it be found that the children of a particular school are specially attacked, it should be ascertained how far the school is itself exercising a prejudicial influence. Such information can only be obtained when it is known for a number of families, whether the first person attacked was the child attending a school, regard being, of course, had to his opportunities for infection elsewhere, and to the susceptibility to disease of other members of each family.

Generally speaking, no child who is not himself free from dangerous infectious disease, or living in the same house with a case of infectious disease, should be permitted to attend school where a number of other susceptible children are. Usually it is sufficient to exclude from school, children who are themselves a source of danger; there are times, however, when the closure of the school becomes necessary in the interests of the health of the community. Such interference with education should not be permitted without much consideration and without strong proof that the continuance of the school is a cause of disease; thus it

should be ascertained whether other opportunities for infection exist which would continue or be increased if the school were closed, such, for instance, as children congregating together at play. And again, if it be found necessary to close a school, it should be learnt whether it would not be sufficient to close that part which would exclude from attendance only those of a particular age. It may, for instance, have happened that the same disease may have been prevalent in the neighbourhood but a few years before, and that only children born since that time are now susceptible to the malady.

The influence of laundries should always be watched. No person suffering from infectious disease should be allowed to remain in a house where linen from other houses is received for washing, and no householder should allow infected garments to be sent for washing to any place before careful disinfection, and unless it can be washed apart from those of other persons. The writer has known one instance in which small-pox was contracted by a laundry-man and became a source of disease to another family through infection of the linen.

But while precautions are taken unceasingly in the directions we have indicated, it must not be assumed that the maximum good has been accomplished. As our knowledge of infectious disease increases, so will our opportunities for its prevention grow likewise. We must then be prepared to accept the teachings which time alone can give, and apply the experience of the past to the prevention in the future of those diseases which may then attack mankind.

ACCIDENTAL INJURIES:

THEIR RELIEF

AND

IMMEDIATE TREATMENT.

How to prevent Accidents becoming more Serious.

BY

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PREFACE.

THIS Handbook is intended as a guide, in simple language, from which the public may learn how to render efficient aid at the moment of injury. Not only are wounds, bruises and broken bones events of every-day occurrence, but a number of minor ailments, which might be relieved by the knowledge of some simple common-sense rules, are taken into consideration and dealt with in a popular and yet not in a superficial manner.

14, SUFFOLK STREET, PALL MALL,
LONDON, S.W., *June 18th*, 1884.

CONTENTS.

LIST OF ILLUSTRATIONS.

ACCIDENTAL INJURIES.

EVERY ONE has within his or her recollection and experience, memories of accidents and injuries, some of greater, some of lesser severity. All must remember, at the time when some particular accident occurred, how bitter was the repentance of ignorance as to what was best to be done, and how earnest the wish that some means of telling what to do were at hand.

To prevent accidents occurring in our streets, factories, and mines, would be to teach people to take care and caution whilst crossing a street; to warn the worker that the sharp saw which revolves as he pleases may one day be his death; and to teach the miner to keep his safety-lamp shut. But not only is it in these more dangerous situations and occupations that care has to be exercised. In the house and the home the most simple things may become instruments of death: the kettle on the fire contains as certain a death to the child wandering near the fire-place as the most rank poison; the lap-dog may become rabid, and cause the torments of hydrophobia; whilst the bread-knife, or the pulling of a cork, may inflict as deadly a wound as a rifle bullet. To prevent accidents occurring lies within the province of the policeman, the local authorities, and the mother of every home; but as accidents will occur, it is expedient to know what to do to prevent them giving rise to more serious consequences still.

It is to this purpose, then, that this handbook is directed: it is to tell the bystander in simple language what to do to stop the flow of blood, to prevent a broken bone doing more

damage, to restore a person from a faint, and to render such assistance as will allay suffering and prevent more serious complications until such time as the doctor arrives.

It is objected to books and lectures of this sort that every one is being taught doctoring, and that "a little knowledge is a dangerous thing," &c., and such-like well-worn sayings. If to tell a mother how to save her child's life be teaching her doctoring, then the sooner she is taught the better. Again, it is not a little knowledge that is to be told you; it is complete of its kind, and there is nothing beyond it that is necessary for you to know upon the subjects dealt with, to enable you to render first aid to injured people correctly.

To the Ambulance Department of the Order of St. John of Jerusalem in England, not only has Great Britain, but the civilized world, to tender thanks and admiration for the introduction of the means of teaching "First Aid to the Injured." In the excellent syllabus published by that association will be found a guide to the nature of the accidents and every-day calamities most likely to be met with, and in the lectures given by the teachers co-operating with that association, the means of rendering first aid are taught both theoretically and practically. The regret is, not that every one is being taught the much-dreaded subject, "a little doctoring," but that such knowledge is not made at least morally if not legally compulsory.

Where freedom exists in such subjects, there will be found plenty of fools to take advantage of it; and just as amongst the seafaring population the knowledge of swimming is the exception, so much more common is it to meet with ignorance unworthy of the brutes in regard to the alleviation of the most ordinary of accidents.

It is difficult to know where to begin to teach such a subject so as to prevent it being merely *parrot-like*, known to-day and forgotten to-morrow; hence it is necessary to tell you something of the structure and functions of the body before launching out into details of how to proceed in cases of injury. You must know the machine before

you set to work upon it; you must know the economy before you begin to set it right. With this short apology I beg of you to bear with me whilst I go through a succinct account of such points in anatomy and physiology as you *must* know.

Now the best starting-point is

THE SKELETON,

because it presents to us something fixed and, for the most part, appreciable to touch, even in the living body.

The best point to start from is the **Backbone,** or backbones as it should be called, owing to its numerous component elements. It also is called the spine, the spinal column, and the vertebral column. The latter term requires explanation. The name *vertebra* is given to each separate segment or bone of which the column is made up; hence the term vertebral column. The separate bones are not allowed to rub one against another, but are tied together by strong fibres and tissues, which at the same time form a pad or buffer to allow of compression and relaxation. This is known as the intervertebral substance, and the next skeleton you have the courage to look at, examine between the vertebræ, and you will observe that pieces of cork are inserted to represent the tissue of which we are speaking.

On looking a little more closely at the spine, you will observe that it increases in size from above, down. It is natural that it should do so, owing to the increase in weight which it has to bear as we progress downwards. The highest vertebræ, those of the neck, termed the *cervical,* support the head. Lower down we meet with the vertebræ of the back, or *dorsal* vertebræ, which, twelve in number, extend from the neck to the loins and support the twelve pairs of ribs. In the next region, that of the loin, we meet with the five *lumbar* vertebræ, they being the only bones met with in the region.

The vertebral column now ends off in two solid pieces of

bone, the *sacrum* and *coccyx*, which have the appearance of having been originally separate pieces of bone, but now grown together. They are both concerned in the forma-

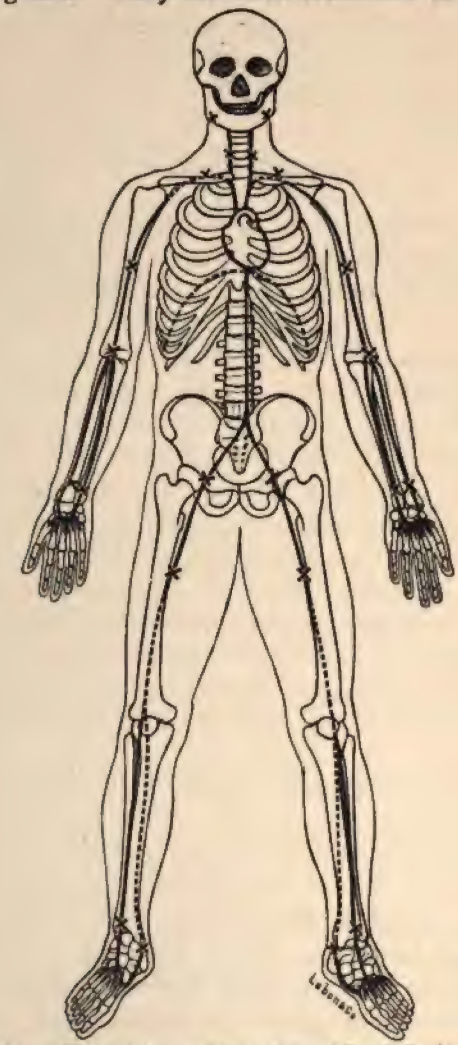


FIG. 1—Showing: 1. The skeleton. 2. Black and dotted lines indicating course of arteries. 3. X X showing where compression may be applied.

tion of the large girdle of bone met with at the lowest part of the trunk under the name of **the Haunch-bone,**

or PELVIS, which receives the weight of the body, and hands it over to the lower extremities. This large girdle is composed, not of a solid continuous piece of bone, but of two halves, separated in front by only a small piece of gristle or cartilage. Behind, however, a wide gap exists between them, and into this gap is fitted the lowest two pieces of the vertebral column, the sacrum and coccyx; all four parts are lashed together by the strongest bands or ligaments met with in the body.

It will be seen that in the coccyx the vertebral column tapers off into a point below, and in animals which possess a tail this is the bone which by its prolongation forms it. On either side of the pelvis, or haunch-bone, a large pit is dug out for the reception of the head of the thigh-bone, and it is here that we first meet with a true joint, in the form of the hip-joint.

A joint may be described as the spot where two bones meet. Over the surfaces of the bones, so as to prevent friction, is a covering of gristle or cartilage. Anointing the joint is a quantity of fluid, "joint-oil," or *synovia*, enclosed in a membrane to prevent its escape. Tying the bones together, so as to restrain the motions of the joint, are a number of bands or ligaments. Briefly, therefore, a joint consists of bones, cartilage, synovial membrane, and ligaments.

Beyond the hip-joint is the **Thigh-bone,** or FEMUR, which, being the only bone met with in the thigh, shows clearly when broken all the signs of fracture. Its upper end consists of a head, supported by a neck, which projects at an angle from the shaft; it is the neck which is so frequently broken, especially in old people. The shaft of the bone, a long thick cylinder, ends below at the knee as two stout knuckles or condyles, which form the upper part of the knee-joint.

The Knee-joint consists of three bones—the thigh-bone, or *femur*, above; the knee-cap, or *patella*, in front; and the shin-bone, or *tibia*, below. This is a huge joint, and is composed of bones, cartilage, ligaments, and synovial membrane, as already described. The knee-joint is an

enormous size, being four times larger than any other joint in the body. Its extent and its proximity to the skin render it apt to get injured, and serious consequences ensue unless care is taken that even slight injuries near the joint are speedily and strictly attended to; otherwise, should inflammation occur in the wound, the joint itself may become inflamed, and there is no knowing where that may end; probably with either a stiff knee, or loss of limb, or loss of life. A knee-joint once weakened can always be felt afterwards; and thirty years afterwards, when the east wind blows, or on a sudden straightening of the limb, "the old hurt" will assert itself by a sudden twinge in the joint.

Beyond the knee we come to the leg, and I beg of you to note carefully the names of the different regions of the lower extremity. They are the *hip*, *hip-joint*, *thigh*, *knee-joint*, *leg*, *ankle-joint*, and *foot*. The leg, then, is only the portion between the knee and the ankle, and the name *lower extremity* is given to the whole limb.

The Leg consists of two bones—the larger one the SHIN-BONE, or TIBIA, on the inner side, and close below the skin; the smaller one the SPLINT-BONE, or FIBULA, on the outer side, and deeply sunk amongst the muscles of the calf of the leg. The tibia is named from its likeness to the old Roman musical instrument of that name, and the fibula from its likeness in position to the clasp of a brooch. These bones are frequently both broken, but the fibula just above the ankle is the bone most frequently broken in the lower extremity. The tibia upon the inside, and the fibula on the outer side, both present below two stout tongues or projections of bones, which serve to embrace the first bone of the foot, the whole constituting the ankle-joint.

The Ankle-joint is made up of the shin-bone or tibia above, the first bone of the foot (the astragalus) below, and on either side the two tongues spoken of (beneath either elastic of the boot, the inner from the tibia, the outer from the fibula), which embrace the astragalus and complete the ankle-joint. Seeing that the structures of a joint are fresh in our memories, we may here discuss :—

A Sprain.—By a sprain is meant a twist, strain or rick occurring at a joint, and of such severity as to cause, it may be, serious trouble. The ankle, the most frequently sprained joint, is especially liable to wrenches and twists from slipping, on a smooth floor, or down stairs, or on a piece of orange-peel and the like on the pavement, or treading on the edge of a fair-sized stone, or putting the foot into a hole on uneven ground, or simply from the tendency "to go over" the ankle.

When from any of these causes a sprained ankle results, what happens is this:—The sudden wrench started the bones from each other for an instant, and during that instant various things occurred. The bands or ligaments which hold the bones of the joint together were suddenly stretched, torn, and made to bleed, the gap which occurred between the bones sucked the blood into the joint, so that the joint instantly swells. Before even the stocking and shoe can be got off, the joint has swollen. Nothing could accumulate at such a rate except blood; and if further proof is wanted, it will be found two or three days afterwards by the skin becoming discoloured "black and blue" when the blood comes to the surface. *To relieve pain* in such an accident, and to prevent more serious trouble, the joint should be kept quiet, and the use of it prevented. To take the pain and sting out of it, the foot and ankle should be placed in hot water (100° F.), if it can be obtained. If the accident occur on a country road, the ankle should be bound round tightly with a handkerchief, either dry or dipped in cold water, or in equal parts of whisky or brandy and water, the stocking pulled over it, and the boot tightly laced; or, without removing the boot, tie a handkerchief tightly over all. If the cold or spirit lotion is agreeable, re-apply it; but if the pain is great, place the ankle in hot water, or apply a hot fomentation, *i.e.* a flannel wrung out of hot water, or a bran poultice with a tablespoonful of vinegar or arnica lotion, or both, over the poultice. In all cases a medical practitioner should examine the joint as soon as possible, as to all but the

skilled, what looks like a mere sprain may be a broken bone.

Beyond the ankle-joint is **the Foot**. Seeing the pressure, at times very sudden, which the foot has to bear, the necessity for a number of small bones in the foot instead of one large bone is readily understood (Fig. 1). A single bone would be apt to get broken, whereas a number of small bones distribute the shock, and lessen it by handing the pressure over from one to another. The first part of the foot proper is called the *tarsus*, consisting of seven bones, one of which forms the heel, and another (the astragalus) forms the lower part of the ankle-joint. In front of the tarsus are the five bones supporting the five toes; they are called *metatarsal*, meaning that they are in front of the tarsus. Finally we have the bones constituting the toes, and going by the name of the *phalanges*, from the fact of the bones being arranged in rows, or like soldiers in a phalanx. The foot has two surfaces—an upper, or back or *dorsum* of the foot; and an under surface, or sole, or *plantar* aspect of the foot. The human being plants his whole foot upon the ground, differing from a dog, ox, or horse, as these walk on their toes; what you call a horse's hind knee, or more technically hock, really corresponds to our ankle, although it is placed almost half-way up the animal's limb.

In this sketch, then, of so much of the bony skeleton, we have seen how the weight of the head was supported by the neck or cervical vertebræ; how that, owing to the increase of weight, from the necessity of supporting the upper limbs, the vertebræ of the back or the dorsal vertebræ became larger, and that the lumbar or loin vertebræ, having the whole of the upper part of the body to support, were huge. It was also pointed out that, at the haunch-bone, or pelvis, the weight divided and passed across the hip-joint to the thigh-bone or femur, from thence across the knee-joint to the shin-bone or tibia, which, along with the small bone or fibula, make up the leg; and that, finally crossing the ankle-joint, the weight was received by the tarsus and handed over therefrom to the sole of the

foot generally. Whilst tracing the weight and the bones which sustain it on the way down, however, it is evident numerous parts have been omitted ; they are the ribs and sternum, the upper limbs and the skull.

The Ribs, or *costæ*, number twelve pairs, exactly the same in men and women, although most have heard of the belief, got from concrete creative notions, that man has one fewer than woman. The upper seven ribs run from the backbone behind to join in front with the **Breastbone,** or *sternum ;* these are called the *true ribs.* The remaining five, which fall short of the breastbone, go by the name of the *false ribs*, of which the lowest two, being free in front, are called the *floating or winged ribs.* The breastbone, or sternum, runs from the root of the neck down to the pit of the stomach.

Enclosed within the ribs are the various organs met with in the chest and upper part of the belly, and it becomes necessary to shortly indicate the positions of the large organs of the body.

The trunk of the body is portioned off by a large muscular partition, the **Midriff** or DIAPHRAGM, which completely divides the trunk into two parts ; the part above it is called the chest, or THORAX, and the part below it the belly, or ABDOMEN. The thorax has bony walls, the ribs bounding it ; but the abdomen is soft-walled, and capable of being easily compressed. The organs contained within the abdomen encroach upon the thorax, so that the ribs give protection to many of the abdominal as well as the thoracic organs, or viscera. This is allowed for by the shape of the diaphragm, which, arching up towards the thorax, as the dotted line shows on figure 1, accommodates the *stomach*, *liver*, *spleen*, *pancreas*, and the upper end of the *kidneys* on its under surface.

The Chest, or THORAX, is bounded behind by the vertebral column, on either side by the ribs, and in front by the breastbone, or sternum. The upper end is at the root of the neck, the lower limit is the midriff, or diaphragm. Its chief contents are the *heart* and the *lungs*.

THE HEART, safely ensconced between the two lungs, rests upon the top of the diaphragm, midway between the backbone and breastbone; it is about the size of the clenched fist of the person it belongs to, whereas each lung is as big as the person's head. Huge things these LUNGS are, reaching from the neck, even above the collarbone, down to the midriff, or diaphragm, and filling the whole area of the chest—front, back and sides. There can be no difficulty in being able to tell where the lungs are, because everywhere where a rib can be felt there is the lung beneath—not far off, but absolutely in contact, so that should a rib get broken, there is danger to the lung on account of the close proximity of the one to the other. The circulation and respiration will be described further on; in the meantime, allow the brief indication of the position of the heart and lungs to suffice.

In the **Abdomen** the organs met with occupy the following positions. THE STOMACH is beneath the region called the "pit of the stomach." THE LIVER lies on the right side. It is a large solid organ as big as the brain, and it pushes up the diaphragm so as to ensconce itself under the cover and protection of the ribs. The position of the liver on the right side may help in the explanation of the use of the right hand; this heavy organ, 50 oz. in weight, placed near the middle of the body, must have some influence upon the rotation of our bodies. However it may be as to the use of the right hand, the fact may help the memory that the liver is on the same side as the right hand, and that pain in the right shoulder may mean disease of the liver.

The SPLEEN is placed on the left side in a line with the stomach, and wholly protected by the ribs. It is almost the size of the palm of the hand, solid in structure, and containing a large quantity of blood. Both the liver and the spleen are apt to get ruptured by blows, but more especially when the lower ribs are broken on the right or left side, so may the liver or spleen respectively get damaged.

The positions of the other organs are easily under-

stood. Every one knows that the kidneys are behind in the region of the loin, that the intestines occupy the chief part of the front of the abdomen, and that within the pelvis lie organs of excretion and reproduction. This must suffice for the position of the organs of the body, and now there remains the upper extremity and the skull.

The Upper Extremity includes the parts known of under the names of the *shoulder*, the *shoulder-joint*, the *arm*, the *elbow*, the *forearm*, *wrist* and *hand*.

The Shoulder is the mass moved when one shrugs the shoulders, when it feels as though half the body was moving. This is owing to the large expanse of the *blade-bone* or *scapula*, and the mass of muscles connected with it. The only other bone met with is the **Collarbone** or CLAVICLE, a narrow rod-like bone, which can be felt as it passes from the top of the breastbone, or sternum, out to the top of the shoulder, where it meets a process of the blade-bone, or scapula, and completes the summit of the shoulder. When these two bones have to sustain severe pressure, as by a fall on the hand or elbow, the collarbone has the full weight to bear, and as it is fixed between two bones it gets snapped and broken, in spite of its S-shaped curve. The curve upon this bone brings the fact home to us, that bones are not stiff and brittle things that snap like a stick of chalk or a piece of dry twig, but behave rather like a piece of green twig, which, whilst it bends easily enough, requires a deal of twisting, twining and wriggling before the two parts can be got asunder. Bones, also, especially in the young, but less so in the elderly, will stand a deal of bending before they break, and this is especially the case with the clavicle, which with its double curve is doubly provided with a power of resistance to fracture from falls on the hand, elbow, or shoulder whilst the child is learning to walk.

The Bladebone, or SCAPULA, on the other hand, is a movable bone, and can, when pressure is exercised on it, move out of the way and save itself; hence, except direct violence be aimed at it, no fracture is likely to ensue. Beyond the shoulder is **the Shoulder-joint**, a joint provided with a

wonderful facility of motion, and capable of the most varied movements. This is allowed for by the shape and condition of the bones forming it ; they are the rounded head of the bone of the arm, the humerus, and the shallow, saucer-like (or glenoid) cavity on the scapula. The cavity is so shallow and small that it does not in any way interfere with the free movements. In this way, then, is it that the shoulder-joint and hip-joints differ, for it is plain they are both situated at the top of the part where the limbs sprout from the trunk, and upon their looseness or fixity will depend the extent of motion with which the whole limb is endowed.

The hip-joint, we saw previously, possesses a cup-shaped cavity, but we find that the shoulder-joint is like a saucer. The head of the thigh-bone is round like a ball, so is the head of the humerus. Now a ball placed in a cup has but little free motion, but on a saucer it can roll about at freedom. But here arises also the source of danger : the shallow saucer may allow the ball to roll over the edge, whereas in the cup it is well-nigh impossible ; similarly, the saucer-like depression at the shoulder-joint may allow the round humerus to slip over the edge, constituting a dislocation, whilst in the case of the hip the cup-like cavity will restrain the head of the femur and prevent dislocation. Hence it comes about that dislocation, *i.e.* the bones slipping out of their sockets, is very common at the shoulder-joint, in fact, ten times more common than all the other dislocations in the body put together.

By a Dislocation is meant the slipping from off each other of the surfaces of the bones constituting a joint ; by a *compound dislocation* is meant a simple dislocation compounded with an injury to the tissues and skin over the joint, in fact, the ends of the bones may protrude through the skin. Seeing that the joint we have just been speaking of—the shoulder-joint—is the most frequent seat of dislocation, it will be well here to dwell upon dislocation for a time. The causes of dislocations are chiefly falls in some position which, catching the joint at a disadvantage, causes the ligaments around it to give way and the bones to slip.

Thus the shoulder is most frequently put out by a fall on the hand or elbow. The elbow, the second most commonly dislocated joint, is also put out by a fall on the hand when the forearm is bent on the arm. A fall from a horse is a common cause of dislocation of the shoulder, hence it is a common hunting-field accident; a backward throw, and the person trying to save himself by putting his hands out behind him, is also a likely position in which to dislocate the shoulder; hence it is common in the foot-ball field, in boxing, and in some forms of wrestling.

The way to tell when a shoulder or other joint is out, *i.e.* dislocated, is:—

1. The person in whom it has occurred, the patient we shall say, feels something has given way.

2. The pain is severe, of a sickening, numbing, wrenching character.

3. The joint is immovable, and attempts at motion elicit severe pain.

4. The part when actually *seen* will be found to be deformed as compared with the joint of the limb on the sound side.

5. The deformity of the parts may be actually *felt*.

6. The change of shape occurs at a joint, and not in the continuity or course of a bone.

TO PREVENT this accident becoming more serious and to allay the patient's suffering, get the limb in as easy a position as possible. If it is in the house, lay the patient on a couch or bed in the position of repose, and place a pillow below the injured limb in the position which is most easy. Slit up the seam of the coat or trousers when the patient is made comfortable, and get the coat and all clothing removed or made easy around the joint. Send for the doctor, but meantime you may apply cold water rags, or a lotion of half spirits (whisky, brandy, gin, spirits of wine) and water, or sal-volatile a drachm (*i.e.* a teaspoonful), to an ounce (*i.e.* two tablespoonfuls) of water. If heat is more agreeable, apply a hot fomentation, *i.e.* a flannel wrung out of hot water, and if it is pleasant to the patient, repeat it

frequently. Should the accident have occurred in the hunting or foot-ball field, or anywhere away from house or home, then the seam of the coat should be slit up, the limb fixed to the side in the most easy position possible; this is done by means of a sling or support (see page 48). If the under-clothing is felt to be pressing, slit up the seam or cut the linen or under-vest, undo the brace on that side, and give the patient a mouthful of water, whisky and water, brandy and water, cold tea, or whatever else of the kind may be at hand. If the patient is near home, take him home; if far from home, with, say a long drive, a ride, or a journey by train, then the nearest doctor ought to be sent for, and one should not yield to the solicitations of the patient who insists that he will be all right when he gets home, or that he wishes "his own doctor" to see it, and what not. Every medical man is capable of reducing a recently dislocated shoulder-joint with or without the aid of chloroform and assistants, and it is only inflicting unnecessary pain to defer the reduction until the patient gets home. He can go home soon after it has been reduced, but it is cruelty to send him twenty miles on a railway journey home from a foot-ball match with an unreduced dislocation. Let none but a medical man attempt to reduce dislocations of the large joints such as the shoulder or elbow. It seems hard to let the patient lie suffering until the medical man comes, but nothing but repentance will follow active interference, and that friend will perform the greatest kindness to the patient who places the limb in the easiest position possible and prevents further interference until the doctor arrives.

A man who has had his shoulder-joint dislocated, will frequently know what to do to rectify the displacement, and will either pull it in himself or tell a bystander what to do.

We have dwelt so long on dislocations that it wellnigh slipped from the memory that we have left the description of the upper limb still unfinished. Well,

The Arm is the name of the section of the limb beyond the shoulder-joint, and in it we have, as in the thigh, only

one bone—the HUMERUS. Its upper end is rounded to form the ball met with at the shoulder, whilst its lower end is broadened so as to give surfaces for the two bones of the forearm to be supported upon.

The Elbow-joint is made up of the arm-bone, the humerus, above; and the two bones of the forearm below. The bones forming it are liable to dislocations and fractures; it is close to the skin, hence any unskilled person attempting anything more than simple measures may do much harm (see p. 177).

In **the Forearm,** as in the leg, there are two bones, but, unlike the leg, the bones of the forearm are nearly of a size; the inside bone, that is, the little-finger-side bone, is called the ULNA; the outside bone, that is, the thumb-side bone, is called the RADIUS, because it twists or rotates or radiates round its fellow. Now between these two bones a motion peculiar to the forearm takes place. To demonstrate this, with the forefinger and thumb of the right hand grasp the bone felt on the little-finger-side of the left forearm, just above the wrist; the bone so grasped is the lower end of the left ulna; now it will be found possible to move the left hand so that now its palm is upwards, now its back, and it is plain that this motion is a motion of the outside or thumb-side bone—the radius, on the inside bone —the ulna. It is observed that the hand moves with the radius, and that it alone supports the hand, so that a fall upon the hand may cause fracture, through the stress thrown on this its supporting bone. The motions so essential to the utility of the human hand, which have been pointed out, are called supination and pronation—*supination* when the palm of the hand is upwards or forwards and the thumb outwards; *pronation* when the palm of the hand looks downwards towards the ground, or backwards, and the thumb inwards towards the body.

These movements have to be carefully preserved when any accident happens to the forearm threatening rigidity.

Beyond the forearm comes the wrist-joint, made up of the forearm bones above, and the first row of the bones of the wrist below.

The Wrist, or CARPUS, is composed of eight small bones in two rows, four in each row. Two lines on the skin in front of the wrist, frequently met with, mark the position of the rows of bones. Beyond the carpus are the five bones supporting the five fingers, and on these bones the front or palm, and the back or dorsum of the hand are placed; they are called the *metacarpal* bones, and they form the knuckles. **The Fingers** are made up, with the exception of the thumb, of three bones called *phalanges*, from being arranged like soldiers in a phalanx; and they are named, commencing from the knuckles, the first, second, and third phalanges, respectively. The thumb, like the big toe, has only two phalanges.

Last of all in the bony skeleton we have to discuss the skull.

The Skull comprehends the brain case or *cranium*, and the *face*. It is balanced on the top of the backbone, the uppermost vertebra of the neck forming a joint with it, at which the nodding motion of the head takes place. The lower limit of the cranium, and consequently of the brain, can be made out by taking a line on either side forwards from where the hair joins the skin of the neck behind, through the middle of the ear, and forwards to the eyebrow. All above this line contains brain.

THE CRANIUM is about a quarter of an inch in thickness, and has the brain in contact with it; hence any injury to the bone will almost of necessity injure the soft brain-mass within. The bones forming the cranium are so fitted by toothed edges into each other that they cannot be displaced; they are named according to their position, *frontal* forming the forehead bone, the *temporal* containing the ear bones, and so on.

Below the cranium is THE FACE, composed of bones arranged to form the nose, orbit, cheek, and mouth. The only movable bone of the face is the lower jaw or *inferior maxilla*, named so in contradistinction to the *superior maxilla* or upper jawbone; the joint lies in front of the ear, and the bone can be felt to move when you place the finger on the skin immediately in front of the lappet of the

ear. This joint may get dislocated, when the mouth will be found gaping, and all attempts at closure will prove ineffectual until reduction is performed. This can only be done by skilled hands, so it must be left to a medical practitioner.

MUSCLES.

Every motion in the body takes place by muscles, be it the blow of a pugilist, the act of frowning, or the glib motions of the tongue. Hence muscles are almost everywhere, and they make up with the bones the mass of our limbs. It is difficult to believe, when first told, that muscle and flesh are the same tissue, but such is the case. What you recognise as flesh, are muscles of either a young animal or one in which much fat has accumulated in the substance of the muscle; what you recognise as muscle are muscles of an old animal, or one which has had to exercise them much in the search of food. Flesh, then, is muscle with fat incorporated in its tissue.

Peculiar to muscular elements is the property of contraction, and it is this property that renders muscle the all-important factor in motion. Every one is familiar with muscular contraction. To illustrate it, let the reader place the right hand over the front of the left arm midway between the shoulder and the elbow ; now bend the elbow, *i.e.* bring the forearm up to the arm. Whilst this is taking place, a hard swelling rises up beneath the right hand, which most people know to be a muscle called the biceps. The cause of its swelling up is that the muscular elements have re-arranged themselves so that the muscle becomes a hard ball, and the effect produced by its swelling up is the motion of the forearm.

The muscles in the limb are thick and fleshy in the middle of their course, but at the spot where they cross joints they form for the most part hard, dense, fibrous bands called *tendons*. These go popularly by the name of "leaders ;" and at the wrist, where we hear of leaders being so frequently strained, we can feel numbers of these

hard cords. In the walls of various organs, such as the stomach, heart, intestine, gullet, lung and bladder, we meet with muscular structures which are not under the direct command of the brain; these go by the name of the *involuntary muscles.* They are regulated by a separate set of nerves (see Nervous System), are at work during sleep, and in appearance and behaviour are totally different from the voluntary muscles or flesh of the body. The mention just made of two sets of nerves brings us to consider—

THE NERVOUS SYSTEM.

The muscles of our limbs, and all our senses, are under the control of the system of nerves called the cerebro-spinal. This consists of the **Brain,** or *cerebrum,* resident in the brain-case, or cranium, and the prolongation from it that goes down the spine, under the name of the pith, or *spinal cord.* From the brain and spinal cord nerves pass to the muscles, carrying impulses to move; they are called *motor* nerves; but there is also an upward current carrying messages from the skin and sense organs to the brain; these nerves are called *sensory* nerves.

FIG. 2.—Showing the Brain, consisting of cerebrum in light, and cerebellum in darker outline. The long perpendicular line is intended for the spinal cord. The lines joining it, the motor and sensory roots of the spinal nerves. The black dots are the ganglia of the sympathetic system in front of the cord.

The two sets of impulse are conveyed along separate fibres which are firmly bound together; but close to the spinal cord the fibres separate, and we see a motor and sensory bundle (see Fig. 2).

The involuntary muscles of the body are under the regulation of a separate system of nerves, which, as it presides over the organs of the more animal or vegetative part of our existence, is called the vegetative or *sympathetic system.* This consists of a double chain of small

nervous masses, called ganglia, united together by nerves. The chains are arranged on either side of the spine. From the ganglia, nerves pass to the heart, lungs, and the organs of the alimentary canal, liver, pancreas, &c.

Hence we find that we have two sets of muscles presided over, in the main, by two sets of nerves; the voluntary muscles by the cerebro-spinal system, and the involuntary by the sympathetic. The chief difference between the two sets is that one, the sympathetic system, acting on the heart, lungs, and digestive system, continues in action from the birth to the death of the individual, knowing neither rest nor stoppage, as we understand rest; whilst the other, the cerebro-spinal system, presiding over the voluntary muscles, requires long intervals of quietude, provided for by sleep.

We have absolute command, then, of the one set, but not of the other: we can lay our pens down when we like, but we cannot stop our heart's beat; we can push away the tempting fluid, but cannot prevent its absorption, or stay its digestion, when once it is swallowed.

The Circulation of the Blood.

The position of the heart and lungs was discussed at page 10.

To understand the course of the blood, look at the back of your hand, and you will see blue vessels (**veins**) immediately beneath the skin. You may be able to follow one of these up the forearm to the elbow, where, in front, two large veins are found. Grasp now the arm above the elbow, and you will find that the veins stand out more prominently. What does this teach you? It teaches you that the blood in the veins is passing from the fingers up the arm towards the root of the neck, and so on to the heart. In the lower extremities, the veins carry the blood from the toes up the leg and thigh, and finally through the body to the heart. All the blood contained in the veins comes, then, to the heart. The blood contained in them is dark purple, waste or venous blood that has been used by the

tissues, and is on its way back to the heart. It there passes (Fig. 3) into (1) the first chamber of the heart (the *right auricle*), and is driven thence, by muscular contraction, into (2) the second chamber (the *right ventricle*). This in turn contracts and sends the blood to the lungs by a large vessel called the *pulmonary artery*. In the lungs the blood is exposed to the oxygen in the air we breathe, and a magical effect is produced. The blood becomes scarlet in colour, purified, as it is termed, and is now ready to go through the body, carrying oxygen to the tissues. It does not, however, go straight from the lungs to the body, but is first collected by vessels called *pulmonary veins*, and is carried back to

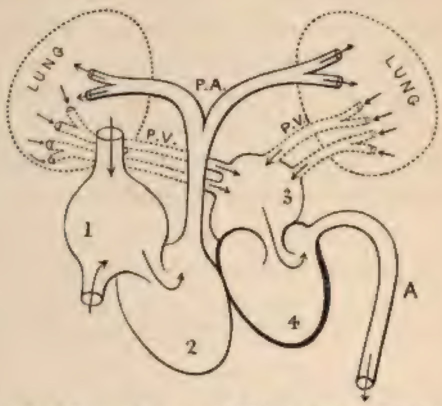


FIG. 3.—Diagram of circulation of blood. 1. Right auricle. 2. Right ventricle. 3. Left auricle. 4. Left ventricle. P. A. Pulmonary artery. P. V. Pulmonary veins. A. Aorta. Commence at cavity 1 and follow the arrows out of cavity 4.

the heart, first to (3) the *left auricle*, or third chamber, hence to (4) the *left ventricle*, or fourth chamber, and finally leaves the heart by a large artery called the *aorta*. It will be observed that the two right cavities contain venous blood, and that the two left cavities contain scarlet, or arterial blood. The aorta is the great arterial stem, arising from the left ventricle, which gives off branches (**arteries**) to all parts of the body, carrying pure blood to the tissues. Each muscular contraction of the left ventricle sends the blood with an impulse into the arteries, causing the increase in pressure we call *the pulse*; and a pulse exists

in the course of the arteries everywhere in the body. The number of times the pulse beats tells us the number of times our heart contracts, because the one is caused by the other. Hence if we feel the pulse at the wrist, and it beats, say, seventy-two to the minute, we know that the heart beats, or contracts, likewise seventy-two times a minute. To find the pulse at the wrist, place the forefinger on a spot an inch above the wrist, and half an inch internal to the thumb-side of the forearm. Arteries can be felt in many other places; for instance, place your forefinger immediately in front of the lappet that projects in front of the ear-opening, and you there feel an artery, the temporal, beat. Now, the quicker the heart beats, the quicker the pulse, and *vice versâ*.

By the aid of a microscope, fine, hair-like tubes, called **capillaries**, are to be seen in all parts of the body. These minute vessels are everywhere: one large muscle may contain millions; they are the spots at which the interchange of fluid and gaseous nutrition takes place, as evinced by the change produced on the colour and character of the blood. The blood *enters* the area of capillaries from an artery as pure, oxygenated, scarlet, or arterial blood, and *emerges* in a vein as impure, dark purple, or venous blood, having lost part of its oxygen and being charged with carbonic acid. The carbonic acid is now conveyed away to the lungs in the venous blood; and in the lungs the blood gives up part of the carbonic acid during expiration, and receives oxygen from the air during inspiration.

RESPIRATION.

Respiration, or breathing, is carried on by the lungs, or "lights," as they are popularly called. The position of the heart and lungs was given at p. 174. The air enters by the nose or mouth, passes to the back of the throat, hence through the larynx, or "apple in the throat," down the wind-pipe, and then through the bronchial tubes into the lungs.

The air around us consists, for the most part, of oxygen and nitrogen. The oxygen constitutes about one-fifth part

of the atmosphere, and is the active element in maintaining life. The nitrogen, however, we inhale as well, but it is passive in its action, serving simply as a diluent.

The process of breathing consists of two steps: the taking in—*inhalation*, and the letting out—*exhalation*. What is inhaled, is air; what are exhaled, are various products from the venous blood. What are these?

1. Water. Breathe on a glass for a time, and it will be found to become dim, and by and by drip with moisture; or when the temperature is low, as on a frosty morning, one can "see" one's breath; this is owing to the rapid condensation of the aqueous vapour in the breath, from its contact with cold air.

2. Heat. When our fingers are cold we involuntarily put them to our mouths and breathe upon them to warm them; hence we loose heat by our breath.

3. Carbonic acid gas. When one sits in a room with doors and windows shut and no fire, the room gets stuffy or close; this is from the pressure of carbonic acid gas escaping from our lungs.

A simple experiment proves this. Put some lime-water in a tumbler, and breathe into it through a glass tube; the lime-water becomes milky white: the lime and the carbonic acid gas have united to form chalk. Hence during exhalation we lose moisture, heat, and carbonic acid gas.

The process of inhalation is chiefly a muscular, that of exhalation a mechanical act. We breathe at the rate of from fifteen to eighteen times per minute.

The Blood-vessels, and Arrest of Bleeding.

The blood, leaving the heart by **the Aorta,** is carried down the front of the backbone, and passes through the midriff, or diaphragm, to reach the abdomen. Its first portion is shaped like the handle of a staff or shepherd's crook, and is called the *arch of the aorta*. It is not a smooth-handled staff, for it is seen that three great twigs or branches come off from it and pass up to the head, neck,

and upper extremity. The first great vessel is the *innominate* (see diagram); it passes upwards to divide into the *right common carotid* and *right subclavian*, which respectively go to the neck and upper extremity. The second great vessel is the *left common carotid*, and the third is the *left subclavian*. So that the vessels, although not at first symmetrical, come after the innominate divides to resemble each other. Following the handle of the staff downwards through the thorax and abdomen, where it is called respectively the *thoracic* and *abdominal aorta*, it is found about halfway down the abdomen to divide into two branches. The large original trunks from the aorta, called the *common iliacs*, divide into two, called *the internal and external iliac* arteries (see diag., pp. 168, 196). One, the internal drops down inside the pelvis and supplies all the organs there, bladder, &c.; whilst the other, the external iliac, passes downwards to the top of the thigh and there enters the lower limb exactly in the centre of the top of the thigh, *i.e.* the fold of the groin. Here, then, a large artery as big as the little finger enters the thigh, and we must consider for a moment **the characters of an artery.**

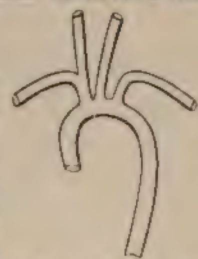


FIG. 4.—Arch of aorta giving off from left to right of diagram. (1) innominate artery, dividing into right subclavian and right common carotid; (2) the left common carotid; (3) the left subclavian artery.

We know an artery carries pure blood, as it is called, from the heart to the different parts of the body, hence the stream is from the heart towards the extremities; in the particular vessels we are now concerned with, it is flowing down towards the feet. The blood is also *scarlet*, not red, but scarlet in colour, as is the case with all arteries. When one gets the finger upon an artery it can be felt to beat or pulsate, and this is the case not only "at the pulse" at the wrist, where we speak of "the pulse" as if there were no other in the body, but wherever one can compress a fair-sized artery against a bone.

There are certain definite bony points against which arteries may be compressed with ease and advantage

and it is these points I want to elucidate and bring clearly home to you. Now you must know first something about

THE COURSE OF THE ARTERIES IN THE LOWER LIMB

The Artery of the Thigh is termed the *femoral* artery but there is no necessity for your remembering the technical name; the artery of the thigh every one understands, so call it that. Entering the thigh in front, in the middle of the fold of the groin, it passes downwards, towards the inner side of the knee (see diag., pp. 168, 196). The position of the artery is exactly found when the knee and hip are slightly bent, by taking a line from the middle of the fold of the groin down to the inside of the knee. A deep wound anywhere in this line is apt to wound the main artery. In many trades such an accident is likely to occur. A shoemaker at work involuntarily brings his knees together to catch the knife he drops; the consequence is that, with the butt-end of the handle against the inside of one thigh and the point of the blade towards the opposite, and the thighs suddenly brought together, the point is sent into the artery.

The main artery in the thigh is a large vessel which, if fairly cut across, would cause death in one or two minutes. Luckily the vessel is not usually completely cut across, but only wounded, when many minutes may pass before bleeding to death ensues. The first officer killed in the last Egyptian war was shot about two inches below the fold of the groin, and the artery completely cut across. The soldiers with him knew not what to do, and in two minutes his young life spent itself on the arid sand. It is as cruel to allow soldiers to go into battle ignorant of the means of stopping hæmorrhage as it is to allow the seafaring population to be ignorant of swimming.

Place a walking stick along the inside of the thigh with its upper end in front of the groin and its lower end behind the knee,—you have at once the course of the artery, and you will see how straight is the course of the

artery. Hence the artery comes to be in front at the hip, to the inner side at the centre of the thigh, and behind at the knee; it in this way avoids the pressure to which it would be subjected were it anywhere else. Were the artery placed behind the hip, every time one sat down the vessel would be stopped; hence it comes in front. Whilst passing from front to back of the thigh, it might have gone down either the inner or outer side; on the inner side it gets protection, on the outer side it would be exposed; hence nature in her wisdom brings it along the inner side to be out of danger's way. Were the artery anywhere else than behind the knee, it would be compressed when one knelt down were it in front, compressed when one brought the knees together were it on the inner side, and exposed to danger were it on the outer side; hence the artery is behind. With these general observations, namely, that vessels pass along the protected part of a limb and on the flexure side of a joint, we can now rapidly finish an account of the vessels in the lower extremity. **The Artery behind the Knee**, the continuation of the femoral, is called the artery of the ham, or the *popliteal;* it is about equal in size to a cedar pencil. It is deeply placed, and can with much pushing and difficulty be felt pulsating. The popliteal artery, or artery of the ham, divides into the **Two Arteries of the Leg.** The large bone of the leg, the tibia, affords protection to the arteries, and baptizes them both *tibial;* one is called the *anterior*, meaning in front of, the other is called the *posterior*, meaning at the back of, the tibia. They are, however, really deeply sunk between the two bones of the leg. Were they otherwise they would be in danger, as no part of the leg is protected either front, back, or sides; hence is it that the arteries are sunk deeply between the bones for protection's sake. So deeply placed are they, that although they do not escape being wounded, still it is impossible to stop the bleeding from them by pressure *on* them either by the fingers or by any appliances. The two vessels pass across the ankle and enter **the Foot**: the one on the front of the

leg passing naturally across the front of the ankle and on to the top, back, or dorsum of the foot; the other from the back of the leg, passing along the inner side of the ankle to enter the inside of the sole of the foot below the instep, where the arch of the foot is. It thus avoids the pressure to which it would be subjected in any other part. As soon as the artery enters the under surface, sole, or plantar region, it divides into two vessels, *the internal and external plantar;* these vessels, a little larger than crowquills, supply branches to the tissues of the foot and the toes.

When an Artery is Cut it is very plain what will take place: (1) The blood will spurt out in jets, the jets corresponding to the pulse, *i.e.* the beats of the heart; (2) the blood will be scarlet in colour; (3) it will flow in a direction away from the body.

BLEEDING FROM ARTERIES.—Now, then, what is to be done when bleeding from an artery occurs anywhere in the thigh? for when you master the principle of stopping bleeding in one region you know it for all others.

The object is to stop the flow. Can this always be done? In the limbs, yes. How? By applying pressure, in some cases on the bleeding point itself, in others between the wound and the heart. Thus in a wound of the artery in the centre of the thigh, the bleeding can be stopped by pressure applied above that point, *i.e.* between the wound and the groin. This is easily enough understood when it is borne in mind that the blood is flowing downwards from the heart towards the thigh. Now, just as you stop a garden watering-pipe that has burst from deluging the lawn by putting your foot on the india-rubber anywhere between the water-tap and the burst point, so may you stop bleeding from an artery; and just as it is well-nigh impossible to stop such a pipe if it goes across a bed of straw by putting your foot on it, so is it well-nigh impossible to compress an artery against soft tissues like muscles. It is important then, to press against something hard, and this is, in the case of a water-pipe, the ground, and in the case of an artery, a bone.

To stop bleeding at any given spot in the lower limb, it is necessary to apply pressure upon the vessel above the wound, *i.e.* between it and the heart. Pressure may be applied by—

1. The fingers. This is technically called *digital compression*, *i.e.* pressure by the digits, or fingers. This is the most useful to know, as you have your fingers always with you, and you can call them into immediate use; bandages, and even pocket-handkerchiefs to be used as bandages, may not be at hand when the critical moment arrives, and pads, such as stones, corks, &c., are always out of the way just when you want them. So trust to your fingers, and most of all trust to your thumbs. Use your fingers, especially your forefinger, to feel with, use your thumb to press with; from its very appearance its broad flat end is evidently meant for pressure, whereas your forefinger, educated to touch, and so sensitive, is evidently intended, and has been trained by generations before us, to become the perceptive organ it is.

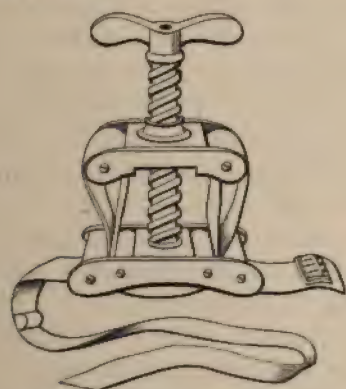


FIG. 5.—Petit's Tourniquet. See pages 194 and 200 for application.

2. Instrumental compression by what are called *tourniquets*. These instruments are specially made, are to be had of any surgical instrument maker, and are of many varieties.

The one figured here is only a type. It is called Petit's,

and has a claim to precedence on account of its excellence and its age. Others are called—Signorini's; the field tourniquet; the winged tourniquet; Esmarch's tourniquet; and the most recent one is an excellent invention, simple and complete, by Mr. Andrew Maclure (Fig. 6).

FIG. 6.—Maclure's Tourniquet.

They all act on the principle of a strap round the limb, with a pad on the vessel, and a screw or wheel apparatus by which to tighten the strap and press the pad further and deeper on to the artery. These instruments are excellent, and fulfil their purposes in surgical operations and in hospitals, but the further discussion of them is useless, as they are not in the hands of the community. It is the principle only which is useful, namely, that a *strap* round the limb, a *pad* on the vessel, and the *means of tightening* the strap, are all that is wanted.

3. Tourniquets may be *improvised* on the principle of the instruments just mentioned, but instead of being provided with ready-made pads, straps and screws, the *pad* may be a stone, marble, cork, snuffbox, piece of coal, piece of wood, pocket matchbox, a small watch, a reel of cotton, a ball of wool, a bunch of keys wrapped up well in a handkerchief, &c., &c. Anything which is hard and handy is all that is wanted. The *strap* around the limb may be a handkerchief—two, if one is not long enough—a leather strap, an

elastic trouser-belt, such as is worn at football, cricket, &c., a trouser-brace, a long cotton stocking, a garter, &c.—anything which is long enough and strong enough to surround the limb, and capable of standing traction without tearing. The *screw*, or wheel, is represented by a stick used to twist the bandage or strap so as to make it tight. To accomplish this, a walking-stick may be used, an umbrella, a key, a pencil, a penholder, a knife (shut), a bayonet, a sword-sheath, a ramrod or cleaner, a policeman's truncheon, &c.—

FIG. 7.—Improvised tourniquet to stop bleeding in thigh.

anything of the kind, which is strong enough whereby to employ force, and which is most handy.

These are the means at our command; and now to apply them.

1. Supposing *a wound in the upper third of the thigh*, say three inches below the groin. What is to be done? Pressure must be applied above the wound by the thumbs (digital compression, that is) at the point indicated in Fig. 8. It is well-nigh impossible to fix a tourniquet here; besides, you must compress with the fingers first on all occasions, so apply your thumbs at the point indicated, namely, the

centre of the fold of the groin, and press straight back.

FIG. 8.—Compression of the artery at the groin for bleeding below that point. N.B.—The thumbs are a little too low down the thigh.

Both thumbs are to be used, the one over the other, as indicated in the figure.

How hard are you to press? Until the blood stops

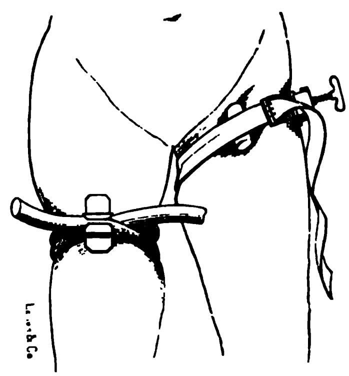


FIG. 9.—On the right thigh is an Esmarch's tourniquet, consisting of an elastic band with a catch to hold it. On the left thigh a Petit's tourniquet is applied.

flowing from the wound below. There is no fear of your not pressing hard enough; you will be so wildly excited

by the gush of blood, and the endeavour to stop it, that you will likely push with all your might. Now the joints of your thumbs are not able to bear the full weight and pressure of your body for more than a minute, and your thumbs will get tired long before assistance can come. You should, then, harbour your strength; and if at first, in the moment of excitement, you press as hard as you can, you will remember, perhaps, by and by that this amount of pressure is unnecessary, and that only sufficient is wanted just to stop the flow of blood.

Is this certain to stop the bleeding? Absolutely, if you have your thumbs upon the artery. How can you tell when you get your fingers on an artery? Because you can feel it beat or pulsate.

Supposing your thumbs get tired, you would ask a bystander, acting under your directions, to slip his thumbs on over yours, and you would then slip yours from beneath his.

Supposing assistance, that is a doctor, is a long way off—say five, ten, forty, fifty miles, as may occur in the colonies—you cannot go on grasping with the thumbs, but you must do the following: Put a pad, *i.e.* a stone, cork, &c., wrapped up in a handkerchief on the vessel immediately above or below the spot at which you are compressing; tie an elastic band, if you can get it, if not, a trouser-brace, or leather strap, &c., &c., round the top of the thigh and along the fold in the groin; and, crossing the ends on the side of the hip, bring the ends round the body, and tie tightly. This will stop bleeding until the doctor comes, when your responsibility is given up.

II. *A wound involving the main artery, the femoral, at or below the middle of the thigh, or the artery at the back of the knee-joint—the artery of the ham*—the popliteal. Proceed as follows:—

1. Compress the vessel at the groin with the thumbs in the way directed (page 174) and get a bystander to make a pad and get a bandage (see page 193).

2. Then apply a pad, *e.g.* a stone, &c., wrapped in a handkerchief (see p. 193, Fig. 7), somewhere in the line

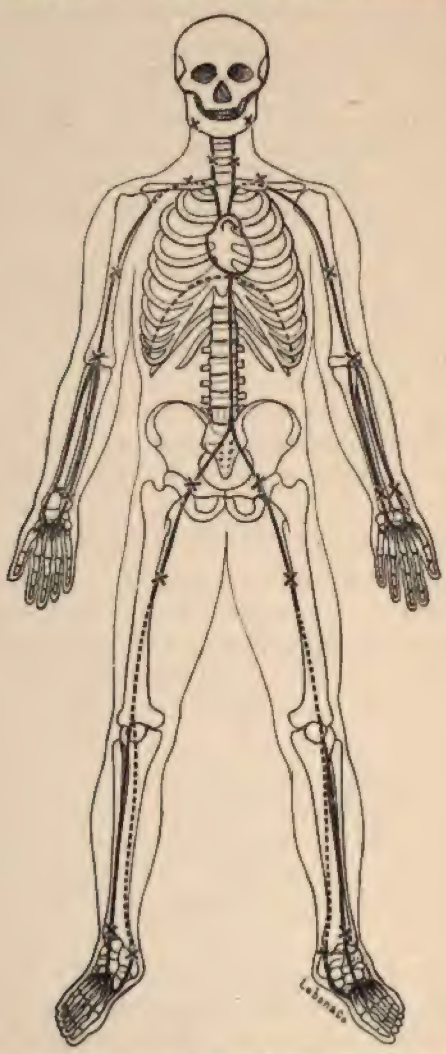


FIG. 10—Showing: 1. The skeleton. 2. Black and dotted lines indicating course of arteries. 3. X X, showing where compression may be applied.

of the artery on the inside of the thigh, and above the wound. Round the limb and over the pad pass a hand-

kerchief, tie the ends with one catch of the knot, *i.e.* with a half knot only, then apply a stick or umbrella on the half knot, and, including the stick, make a complete knot ; the stick which is to be used as a tourniquet is tied between or in the knot. Now twist the stick until the bandage gets tight, and the bleeding is controlled. Whoever has the thumbs on the artery may not remove them until the stick is being twisted. When the bleeding has stopped, fix the stick, umbrella, or what-not, by tying it to the limb above and below the seat of the tourniquet. It will thus act as a splint and keep the leg still. In this state the patient can be moved on a stretcher or in a vehicle to the doctor. If on the way there the bleeding recurs, undo the ends of the stick, and give it another twist, replacing it again by the side of the limb.

You will be anxious to know how long this tourniquet can be left on. Until the doctor comes. But supposing he does not come for six hours—you can do this : after an hour or two, you might carefully undo the stick above and below, and slowly and gradually untwist, keeping your eye fixed on the wound. On the blood appearing twist the tourniquet tightly again and fix it. At the end of another hour or two, you may untwist slowly again. Supposing this time no bleeding occurs, you ought, having slackened the tourniquet, to leave it applied loosely, so that on the reappearance of bleeding it may be twisted up immediately. Never remove the tourniquet altogether before the doctor has seen the patient.

III. *Wounds of the arteries in the legs* are not very common, but when they do occur—

1. Compress the artery of the thigh by digital compression. (See Fig. 8, p. 194.)

2. Apply a pad and tourniquet over the artery in the thigh (Fig. 7, p. 193), and apply a piece of lint or handkerchief soaked in cold water on the wound, and tie it tightly with a handkerchief or triangular bandage.

3. Another method is to put a pad behind the knee, and,

flexing the leg forcibly, tie the leg to the thigh, as indicated in the diagram.

FIG. 11.—Stopping bleeding from the leg by a pad placed behind the knee joint.

IV. *The arteries of the foot* may get wounded either above or below; above by something falling on the foot, below by treading on a piece of glass, &c. What is to be done?

1. Get the boot and stocking off quickly—cutting both.

2. Place the thumb on the bleeding point. The tissues here are so dense and thin that direct pressure will be of avail.

3. Now do one or other of the following:—

(*a.*) Apply a pad (a conical-shaped one is best) on the wound, and tie it on tightly with a handkerchief or triangular bandage put on like a figure of 8 round the ankle. If this be insufficient,

(*b.*) Place a pad, a couple of corks, one on the front, the other on the inside, of the ankle-joint, and tie tightly round with a handkerchief. (See the x x marked on Fig. 10, p. 196.) If this be insufficient,

(*c.*) Put a pad behind the knee, and double the leg on the thigh. (See Fig. 11); or,

(*d.*) Put a pad and tourniquet on the artery in the middle of the thigh. (See Fig. 7, p. 193).

So much, then, for the main arteries of the lower extremity.

It is now necessary to revert, and to follow the vessels spoken of as coming off from the arch of the aorta,—they are two arteries to the head and neck, the *carotids;* and two arteries to the upper extremity, the subclavians,—and to see what can be done to stop bleeding in the regions to which they go.

In the first place, then—

The Arteries of the Upper Extremities.—Coming off as the diagram indicates, p. 187, each of the arteries to the upper extremities, THE RIGHT AND LEFT SUBCLAVIAN, passes up to the root of the neck, lying immediately behind the collarbone. To feel either vessel, and to ascertain its position, you may either bare your own neck, and standing in front of a looking-glass take a deep breath, when a hollow, "the bird's nest," is seen to become apparent just above the clavicles, or you may get a friend to bare the neck

FIG. 12.—Compression of the artery behind the collar-bone to stop bleeding from the armpit.

when the same thing may be seen. Into this hollow push the thumb or forefinger downwards against the first rib, when the artery can be felt to pulsate. We shall see by and by that this is the means of compressing it. The subclavian artery passes from behind the collarbone down to the armpit. The technical name for **the armpit** is the *axilla,* hence the artery, vein, &c., are called

THE AXILLARY—When on a cold day you put your

fingers into your armpits to warm them, and press your arms to your side, you can feel an artery beating against the back of your fingers—that is the axillary artery.

The axillary artery leaves the armpit and enters the inside of the arm, where it is called **the artery of the arm**, or

THE BRACHIAL.—The guide to this vessel is the inside seam of the coat or jacket. Catch hold of your own left coat-sleeve at the wrist with your left hand, and get your left forefinger upon the seam. Now look up the seam, and you will see that it comes from the armpit along the inside of the arm, and finally into the front of the elbow-joint. That is exactly the course of the artery, and your finger placed upon it anywhere will feel the artery beat. Supposing the coat is off, the general idea of the course of the artery is gathered from what has been said, but its actual course is found on the hollow along the inside of the biceps muscle, which forms the swelling and prominence in front of the arm. This vessel may be compressed by the fingers—digital compression—in the middle of the arm, thus:

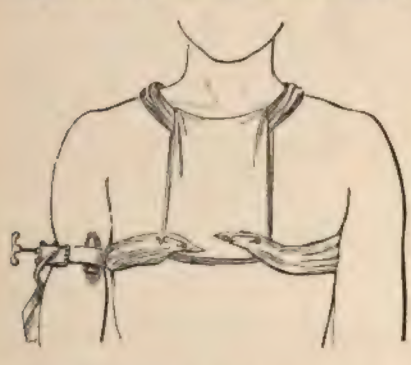


FIG. 13.—On the right arm is a Petit's tourniquet applied. On the chest are bandages applied to keep on a dressing or poultice.

FIG. 14.—Compression of the artery in the arm by the fingers.

To compress the artery in the left arm. Stand behind the left arm, and pass the fingers of your right hand in front of the arm until the finger-points are well to the inside of the biceps muscle; then grasp the limb firmly. The artery will be felt beating, and if the forefinger of the left hand

be applied to the pulse at the wrist (see below) it will be felt that the pulsation ceases, or goes on, according as you tighten or relax the right hand, which grasps the arm and commands the artery. The artery in the right side may be controlled in a like manner. Instead of passing the fingers in front, they may be passed behind the limb, and the artery grasped from the back of the arm, as it were. This is the best plan in a very muscular arm.

The artery now passes from the front of the elbow **to the forearm**, where it immediately divides into two vessels of nearly the same size. The vessels in the forearm, as in other parts, pass along the protected side of the limb so that both come to be in front. When any danger approaches, one naturally throws up the forearm to ward off the blow; were the blood-vessels on the back of the forearm the blow would endanger them, hence nature has placed them in front, where we have two vessels corresponding to the two bones. The bones are nearly of a size, hence they claim and baptize an artery each,—one the ULNAR artery, in front of the ulna, the other the RADIAL, in front of the radius. The vessels are about the size of goose-quills.

The outer artery, the radial, is the one in which the pulse is felt. THE PULSE is the beat of the artery felt at the pulse hollow of the wrist, which is placed one inch above the wrist and half an inch from its outside, that is the thumb side of the forearm.

The arteries at the wrist behave differently in regard to the way they enter the hand. The one on the inner side, *i.e.* the little-finger-side—the ulnar—passes on to the front of the wrist, and runs along the "line of life" at the ball of the thumb. The other, on the outside or thumb-side—the radial—passes on to the outside, then on to the back of the wrist, and disappears deeply between the thumb and fore-finger to reach the palm of the hand.

It is considered very dangerous to cut one's self between the thumb and forefinger; so it is, if the cut is deep enough, because the artery might be cut as it passes from the back of the hand to the palm of the hand.

In the palm of the hand the two arteries form *arches:* one immediately below the skin, the other deeply on the bones, and both arteries help to form each arch. From the arches branches are continued forwards to the fingers, where they pass along the sides, and are thus out of the way of danger and compression as much as possible.

The lowest available spots at which to apply pressure are on the arteries immediately above the wrist. It can be applied by the thumbs placed as in the diagram, when hæmorrhage from the hand can be controlled by pressure at the points indicated.

FIG. 15.—Compression of the arteries at the wrist—the radial and ulnar—by the thumb, to stop bleeding from the hand.

We are now in a position to know *what to do should severe arterial bleeding take place anywhere in the upper limb.*

I. Supposing severe bleeding were to take place from a *wound in the hand,* say from one of the palmar arches :—

(*a.*) Apply the thumb on the bleeding point at once ; if the doctor lives near, keep the thumb there till he comes ; if he lives at a distance,

(*b.*) Apply a stout pad so as to fill the palm of the hand, and, doubling the fingers over the pad, tie the whole tightly with a handkerchief or triangular bandage. Apply a sling, and take the patient to the doctor. Supposing this is not sufficient,

(*c.*) Take a cork, cut it lengthwise, and apply one half

on the thumb-side of the wrist, the other on the little-finger-side, at the spots indicated on Fig. 15. Lay the corks lengthwise to the wrist, and place them with their rounded surfaces on the skin. Fix the pads in position with a bandage. Apply a sling.

(*d.*) Another method is to put a pad on the front of the elbow, and double up the forearm on the arm, and tie the two together: then tie the limb to the side. (See Fig. 16.)

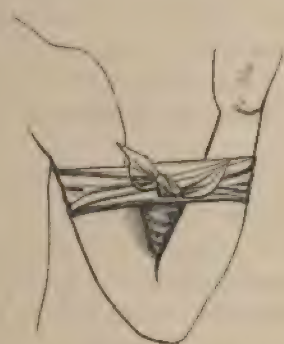


FIG. 16.—Compression of the artery at the bend of the elbow to stop bleeding from the forearm or hand.

(*e.*) Instead of using pads the arteries at the wrist may be compressed by the thumbs, as at Fig. 15; or the artery of the arm may be compressed by the finger, as at Fig. 14, p. 36.

(*f.*) An improvised tourniquet may be applied to the artery in the arm. (See page 200.)

II. *Arterial bleeding in the forearm* may be stopped by—

(*a.*) Doubling up the forearm on a pad (Fig. 16); or

(*b.*) Compressing the artery in the middle of the arm by a field- or improvised tourniquet, or by the fingers.

III. *Arterial bleeding at the elbow or lower end of arm* may be stopped by—

(*a.*) Compressing the artery in the middle of the arm by a field- or improvised tourniquet, or by the fingers.

IV. *Arterial bleeding from the armpit* may be stopped by compressing the artery behind the collarbone (see page 199), by applying the thumb in the "bird's nest" just

above the collarbone, and pressing down with all your might (Fig. 12, p. 199). The pressure is directed against the first rib. Instead of the thumb, a key wrapped in a fold of the handkerchief may be applied.

The only arteries that remain to be followed are the **carotids**. These arise as seen in diagram (page 187), from which point they ascend, as the *common* carotid arteries, on either side of the windpipe towards the skull. Their pulsation or beat can easily be felt on one's self. Each artery divides into two—one, the *external* carotid, to supply the outer parts of the head, the larynx, tongue, face, nose, scalp and back of head; the other, the *internal* carotid, to supply the parts inside the cranium, and chiefly the brain.

When wounds of the carotid arteries occur, as in cut throat, pressure is to be applied by the thumb below the wound by the side of the windpipe on which the wound is. No tourniquet can be applied here; the thumb alone must be trusted to. (See Fig. 17.)

FIG. 17.—Compression of common carotid artery to stop bleeding from wounds of the arteries higher up.

Almost any one of the branches of the external carotid may be wounded :—

1. *Bleeding from the tongue* may generally be stopped by giving ice to suck, if it can be got; if it cannot, washing

the mouth with cold water, loosening tight clothing about the neck, opening the windows and doors so as to get cold air to breathe, and causing the patient to breathe through the mouth.

If the wound is far back, it may be necessary to compress the artery in the middle of the neck on one or both sides until the doctor comes.

2. *Bleeding from the lips* may be very severe; it may be stopped by compressing the lip between the forefinger inside the lip and the thumb outside, on one or both sides of the wound.

3. *Bleeding from the nose* may come from a fall or blow, or it may be the result of constitutional disturbance, and the sign of disease. From whatever cause, it must, when excessive, be stopped. A doctor should be sent for if the bleeding is very severe; but whilst he is being fetched, attempt some of the following restoratives:—Open the windows, and undo tight clothing about the neck. Do not let the patient hang the head over a basin, but lay the patient on a chair or couch in the position of repose; raise the arms, stretched to their full extent, above and rather behind the head. Apply a cold wet sponge or towel to the back of the neck, turning down the collar of the coat, vest, and shirt to reach the proper spot, which is just at the top of the back, between the shoulders; a large key, or a bunch of keys, are the usual remedies, and they are as effectual as anything else, provided they are kept cold. Over the forehead, just at the root of the nose, a cold sponge, or a piece of ice in flannel, or an ice bag, may be applied. If the bleeding still continue, syringe the nose with cold water; or a strong solution of alum and water, or strong cold tea may stop it. If all these efforts are of no avail, pinch the nose just where the bones and the gristle (cartilage) join (that is, about half-way up the nose) between the finger and thumb. If this does not stop the bleeding, and the doctor has not come, take a piece of handkerchief or soft rag of sufficient size, and, wrapping it up tightly, push it into the bleeding nostril.

It may be impossible by all these means to stop the bleeding, and it will require medical skill to plug the nostrils front and back.

4. *Bleeding from the face*, below the eyes, may be stopped by grasping the whole cheek as far out as the wound, with the finger inside the cheek and the thumb outside; or by applying pressure on the edge of the jaw at the back part with the finger laid lengthwise, because there the artery to the face comes over the jaw from the neck (Figs. 1 and 10). Instead of the finger, a long stout pad may be so tied on as to stop the bleeding. The bandage or scarf used must pass below the chin, then upwards to the top of the head, where the ends are crossed, not tied, but brought down below the chin and tied there, pulling tightly—in fact, tight enough to stop the bleeding.

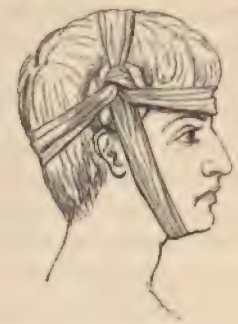


FIG. 18.—Stoppage of bleeding from the temple by a pad and twisted bandage

5. *Arterial bleeding from the front of the head, temple, top or back of the head*, may be stopped, when from a small wound, in this way:—apply a pad, of about one inch in thickness, and in the form of a cone. Make the pad of pledgets of lint, folded tightly and laid one on the top of the other, a penny-piece being folded up in the last pledget. The point of the cone is to be applied on the wound, and a bandage carried round tightly. The way to apply this bandage is represented in Fig. 18, where it is applied to keep a pad on a bleeding artery in the *temple*. First, the pad is placed on the wound; then

a scarf or triangular bandage, folded narrowly, is placed with its centre on the opposite side of the head; the ends are next brought round and twisted once, twice or thrice firmly and decidedly immediately over the pad; the ends are then either carried round the head (or one end passed over the top of the head, the other one beneath the chin), and tied on the opposite side, or where they happen to meet.

The same method may be followed with bleeding at the *top of the head*, viz. a pad over the wounded vessel, a scarf or folded triangular bandage with its centre applied below the chin, the ends twisted on the top of the head over the pad, and brought down again and tied below the chin. The same principle may be followed with bleeding from the *forehead*. Apply a conical pad over the wound; fix it with a scarf or folded triangular bandage, applying the centre of the bandage at the back of the head, bringing the ends forward and twisting them over the pad, and tying them at the back of the head. The same method may be adopted, but with exactly reverse steps, for the *back of the head*.

Bleeding from Veins.—The veins which are most likely to give rise to dangerous bleeding are the veins of the legs, and these chiefly when they become varicose or dilated. Still it does occur that venous blood is lost in quantity in other parts of the body where veins come near the surface, as in the neck or at the bend of the elbow. Blood coming from a vein can be easily recognised—

1. By the dark colour; it is purple, or bluish-purple, or bluish-black in appearance.

2. The blood comes in a sluggish stream when a large vein is wounded, or simply wells up as a dark oozing flow when a smaller vein is wounded.

3. The blood comes from that end of the cut vein which is away from or most distant from the heart. In varicose veins, however, it comes in huge quantity from the end nearest the heart, as well as in smaller quantity from the end farthest away.

To stop bleeding from a vein—

1. Apply the thumb immediately on the bleeding point; moderate pressure will be sufficient to stop the flow of blood from even a large vein.

2. If it is in the limbs, a pad made of some hard substance is to be applied *on* the wound, and tightly fastened with a bandage, handkerchief, or scarf. If the wound is a large one, pressure might have to be applied immediately *below* the wound in the course of the vein. If it is a varicose vein, pressure *on* the wound may suffice, but if it is a large wound opening up a varicose vein, pressure *above and below* the wound would be necessary. In all cases elevate the limb.

A vein bleeding in the neck must be stopped, as in the case of an artery in the neck, only by the thumb, until a doctor sees it.

Capillary Hæmorrhage is the hæmorrhage which occurs when the skin is cut. The capillaries are everywhere, are in large numbers, are microscopic, and when even a moderate or small sized cut is made they bleed by hundreds. The bleeding from a capillary is recognised from the facts that—

1. The blood is red in colour. Arterial blood we saw to be scarlet, venous blood to be dark purple, but capillary is red.

2. The blood comes from all parts of the cut surface; this is evidently what must occur, as the capillaries are everywhere.

3. The blood comes in a brisk, smart, free stream, different from the sluggish flow of venous blood on the one hand, and the jets of an artery on the other.

To stop capillary hæmorrhage many manipulations and remedies are employed:—

1. Compress the bleeding point with the thumb; you may keep it compressed, if your own finger is cut, for five or ten minutes. This may stop it altogether.

2. Instead of the finger, a pad of lint rolled up firmly may be applied and bandaged tightly to the wound.

3. Styptics (these are means of causing the blood to clot or coagulate) may be applied; they are:—

(*a.*) Cold, in the form of cold air, cold water, or ice. Waving the cut finger above the head may help to cause the blood to clot; cold water, although it seems at first to favour the flow of blood, aids in stopping it; a piece of ice is invaluable, especially in internal hæmorrhages.

(*b.*) A piece of wool, a cobweb, a piece of tobacco-leaf, cold tea, &c., are all of them household remedies, and at the same time their action is capable of scientific explanation. The first two mentioned present a mesh-work in which the blood is caught, and has an opportunity of coagulating; the last two contain specific substances which tend to cause blood to coagulate: tobacco-leaf contains nicotine and other substances which cause a painful nipping sensation in the wound; whilst tea contains tannin, especially when drawn for a long time, and is a strong styptic.

(*c.*) Iron drops. The perchloride of iron applied on a minute pledget of lint and pressed into the wound is a pretty sure and safe styptic.

(*d.*) If the wound is small, but pretty deep, and capillary hæmorrhage active, as after a leech-bite, and the doctor is a long way off, or you are on board ship, summon up courage to pass an ordinary sewing needle through the skin, transfixing the wound; over this apply a thread (reel cotton will do) figure-of-8 method, which, when pulled tightly, will stop the bleeding.

WOUNDS.

I. *Incised* wounds are such as are produced by a cut with a knife. Treatment: Wash the part, and stop the bleeding. If the wound gapes, pull the edges together with ordinary diachylon plaster. To heal it, and keep it clean, apply cold water dressings or Friar's Balsam.

II. *Contused* wounds are bruises or contusions of a part with a tear of the skin, as are inflicted by a blow with a club. Treatment: Do not bring the edges together by strapping plaster, but apply a spirit lotion made of one-

third spirits of wine and two-thirds water, or whisky one-third and two-thirds water, and cover over lightly. For *severe bruises*, use either flannels wrung out of hot water, or apply cold lotions,—either simple water, or whisky and water, or arnica lotion. Use whichever is most agreeable to the patient. If the bruise is near a joint put on a splint.

III. *Lacerated* wounds are those produced by a piece being torn off, such as happens in accidents from machinery. Treatment: There is usually no bleeding to stop. Wrap the part up in flannels wrung out of hot water, and treat the patient for shock (see page 236).

THE TRIANGULAR BANDAGE.

In our fathers' days pocket-handkerchiefs were of such ample size that triangular bandages were always at hand. Since, however, handkerchiefs have become reduced in size and of finer texture, they are useless as slings or bandages. To replace them for these purposes the triangular bandage has been devised. It is nothing new; our fathers carried them in their pockets, and our mothers on their shoulders in the form of a small shawl, but we have to resort to a special device to supply its place, as fashion has condemned the use of such articles of apparel.

To make triangular bandages secure some yards of unbleached calico; take a piece of this, one yard square—that is, 36 inches every side—and cutting from one corner to the opposite corner you will get two triangles. If it is for a big man, you will require the bandage to be 38, 40, or even 42 inches square.

The named parts of the bandages are seen in Fig. 19: the *apex*, A; the *base*, B; the *ends*, E.

To fold this bandage for application, you should lay the bandage on the table or floor and stand opposite the base; then seizing the apex A with the right hand, bring it down to the centre of the base B; fold again towards yourself, doubling it—this is a *broad folded bandage;* fold again in the same way—it is now a *narrow folded bandage.*

The methods of application are sufficiently indicated by the diagrams, so that a detailed description of each is useless. As an example of one. To apply a sling (p. 212): Stand in front of the person to be bandaged. Place the apex beneath the elbow of the injured limb, and lay the upper end across the top of the opposite shoulder. Lay the forearm across the chest, bring the lower end upwards over the forearm, and tie the ends by a reef-knot on the top of the shoulder. The knot should be on the same side as the injury and pretty well down towards the front of the shoulder, so that it will not cause inconvenience. The apex projecting behind the elbow is now to be pinned over the arm.

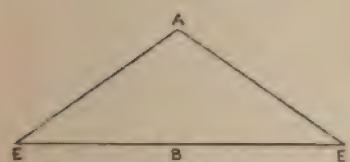


FIG. 19.—Triangular bandage. A, apex; B, base; E E, ends.

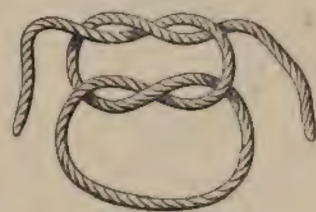


FIG. 20.—A reef knot.

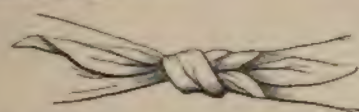


FIG. 21.—Appearance of bandage tied with reef-knot.

The only points to be sure of are, that the hand does not drop below the level of the forearm, and that the knot is properly placed so as not to hurt. The knot should be a sailor's or reef-knot, not a granny (see Figs. 20 and 21). This is to prevent slipping.

FRACTURES.

Broken bones are occurrences of an every-day experience in the streets, mines, on board ship, and even in house and home. The regulation of traffic in our crowded thoroughfares has done much to stop such accidents in our

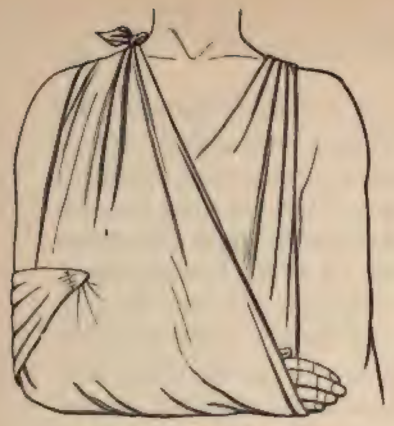


FIG. 22.—Larger arm sling.

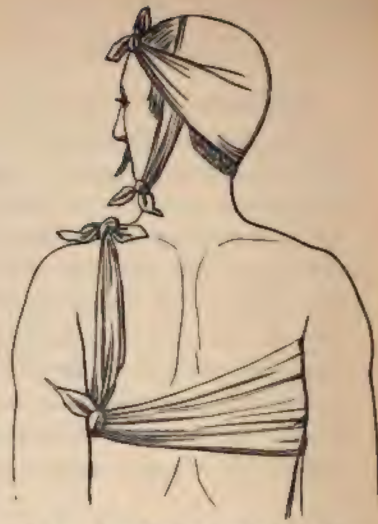


FIG. 23.—Four-tailed bandage for back of head. Triangular bandage applied to chest.

FIG. 25.—Four-tailed bandage applied for broken lower jaw. Bandages applied to keep a dressing on the shoulder, with smaller arm sling. Bandage *for hand.* Bandage for hip.

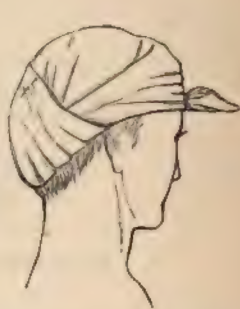


FIG. 24.—Triangular bandage applied to scalp.

FIG. 26.—Bandage for foot. (The knot should have been below.)

streets; and since policemen have been stationed at the *corners* of streets and crowded places, any hospital surgeon will tell you of the diminution in the number of street accidents concurrent with that change. On board ship their frequency is diminished from the lessened necessity of going aloft in modern times. Still the number of preventable fractures is immense, and we must discuss them pretty fully if we are to understand what to do.

Bones are broken in many ways, but amongst the legion of causes, it is possible to classify them under two heads: *Direct* fractures, as when a cart-wheel goes across the leg and breaks it at the part where it crossed. *Indirect* fractures, as, when lighting on the hands in trying to save one's self when falling from a height, the collarbone is broken.

A variety to be mentioned, also, is when bones break by the force of the action of muscles, as when the knee-cap is broken in attempting to jump, or on missing a step on the stair. Now when a fracture has occurred, no power on earth can by immediate treatment join the bones together at once; but by immediate action and treatment on the part of the bystanders or friends, a fracture which is simple at first may become in unskilled hands a much more dangerous accident, whereas in skilled hands it may be prevented from becoming worse. That is all that it is necessary for you to know, viz. *how to prevent a broken bone giving rise to more serious trouble*, it may be loss of limb or loss of life.

Of course a doctor cannot be at the patient's side immediately—that is, in half a minute—however close he live, and it may be hours before a medical man can reach the patient. It matters not whether it be five minutes or hours; it is your duty to know what to do for these five minutes, because all the damage may be done, and generally is done, within that time.

To understand the preventable occurrences that may follow on a broken bone, it is necessary to know the different kinds of fractures:—

1. A *simple* fracture is one in which a bone is simply

broken into two pieces; no joint is injured, no vessel torn, nothing is injured except the bone and its immediate surroundings.

2. A *comminuted* fracture is one in which the bone is broken into several pieces—smashed, in fact. The injury is also in this case confined to the bone.

3. A *complicated* fracture is a broken bone complicated by an injury to the surrounding structures; in the case of the limb-bones it may be an artery, vein, or nerve that is torn, or a joint that is opened; in the case of the ribs the lungs may be torn; in the case of the pelvis, it may be the bladder; in the case of the cranium, it will be the brain.

4. A *compound* fracture is one in which there is a broken bone compounded with an injury to the skin. This differs from all the previous kinds, as in it the skin is torn and the air communicates with the ends of the bone.

It is the last two fractures which are preventable, as the general cause of their occurrence is from careless movement on the part of kind but ignorant bystanders or friends. The willing friend may by his proffered help and kindness be the means of sacrificing limb or life through ignorance. A simple fracture may be so unskillfully handled that it may become complicated or compound, involving weeks longer of confinement to bed, not to speak of the dangers to limb or life that ensue from tearing the main artery or vein of a limb, or sending the end of the bone through the skin.

How can you tell when a bone is broken? To illustrate this we shall imagine the thigh-bone broken about its middle. As there is only one bone in the thigh, so consequently we shall see the full effect of a broken limb-bone.

You can tell the thigh-bone is broken from the following signs and symptoms:—

1. The patient will have fallen down and be unable to rise.
2. The broken limb or limbs will be motionless.
3. You may see the mark on the skin or clothing where the cab-wheel ran over the patient.
4. You will observe that the foot is in some unnatural

position, being flat upon its outside, or in some position it could not be in unless the bone were broken.

5. The limb of the broken side will be shorter than its fellow, as seen by looking at the feet.

6. Could you see or feel the seat of the fracture you could both see and feel that there is a swelling at the seat of the fracture, caused by the broken ends of the bone overriding each other.

7. The patient can refer you to the broken spot by the pain felt there.

8. When you get your hand on the part, and should the patient move the limb, you may feel grating or *crepitus* of a nature peculiar to fracture. It is caused by the rough ends of the bones moving against each other.

9. The patient may tell you of a snap or crack felt at the time of the accident.

In the case of a broken thigh-bone all of these signs and symptoms may be made out, but in the case of other bones only a few may be present. Thus in the case of a leg-bone, there would not be so much shortening, and the foot might be only slightly misplaced ; the cause might be an indirect fracture, as on alighting on the feet, when there would be no marks on the skin or clothing, and so on. Still, it is but seldom that the signs of fracture are not apparent.

There is a variety of fracture I must tell you of, just to teach you the true nature of a bone. It is what is called *green-stick* fracture. It occurs in children ; their bones are soft like gristle, and they bend considerably before they break, and they differ as much from the bones of old people as does a dried stick or withered twig of a tree from a green branch. A dried branch snaps straight across, but a green twig bends and gives or cracks along one face, and may require to be cut through before the ends can be severed. So it happens with children. A nurse carrying a child in her arms, and looking one way whilst the child looks another, the child overbalances, falls back, and the nurse to save it grasps its lower limbs

to her side. The weight of the child's body snaps the thigh-bone or bones, it may be across her fore-arm. It is generally a green-stick fracture that occurs on these occasions, and it shows you how elastic a thing a bone is, and how it will bend before it breaks.

Another variety is what is called an *impacted* fracture. It will be described when speaking of the forearm.

The next thing to know is—

What to do when a broken bone occurs.—Well, first and foremost, and I should like it printed in large letters and sent about the country, *attend to the patient at the spot where the accident occurs.* The patient must not be moved from the centre of the street to the pavement, but attended in the middle of the street; it matters not if it is at the crossing of the most crowded thoroughfare, it is there where you must render aid. You need not move the patient out of the way of cabs and vehicles. No one was ever run over twice, and if *you* kneel down to attend to the injury you are in no danger of being run over. Is it never right to move the patient? Would it not be right to move the patient from the foot of the stair where he has fallen to a comfortable couch before attending to the injury? No. Would it not be right to move the patient from where he lies in the middle of a football field with a broken thigh? No. There is no departure from the rule when any bone in the lower extremity is broken; it must be attended to *before* the patient is moved.

Why is it dangerous to move a patient before fixing the limb? Because a simple fracture might be made into a complicated or compound. The artery of the thigh lies close against the thigh-bone; the jagged edge of the bone is quite near the tender vessel; and any further movement might easily send the broken end through the vessel. Again, the shin-bone, if broken, may be with but little motion sent through the skin immediately beneath which it lies. What is the usual course of events? A child's leg is run over by a cab; any one seeing the accident runs forward, and, lifting the child, carries it to the pavement,

and then to the hospital or to its home. In the process, the child's legs are dangling over the "good Samaritan's" forearm, and the weight of the foot has caused the ends of the bone to come through the skin. Pour oil into the wounds first, and *then* set him upon the ass, is the Scripture teaching, and you cannot do better than follow that; apply your splint first, and then put your patient on a stretcher.

Supposing, then, you find a man lying in the street with A BROKEN THIGH-BONE (and you can tell it is broken by some of the common-sense symptoms and signs I have told you) what would you do?

1. Grasp the foot firmly to prevent it moving about, or to prevent the patient moving it, which he will do if intoxicated.

2. Pull the foot down until it is the same length as the other, and hold the two feet firmly together.

3. Do not let go, to go in search of a splint or help. If there is no one by to help you, as in a country lane, grasp the feet with one hand and get out your handkerchief or scarf with the other, and tie the feet together. You may then let go, and proceed to apply a splint. This would, in the house, be a broom-handle; in the football field a goal-

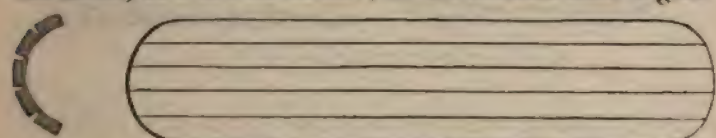


FIG. 27.—Flexible wooden splints of thin strips of lath fastened on leather. Left-hand diagram shows the same bent, and in section.

pole; at military exercises, a rifle; in a country lane, your own or the patient's umbrella or walking-stick; or any thing that is stiff and long enough. Properly speaking, for the thigh the splint ought to go all the way from the armpit to beyond the boot; hence a musket, broom-handle, goal-pole, or the like, is better than an umbrella or walking-stick, except in the case of a child, where the latter would be long enough. But it may be you have no walking-stick, not to speak of the other appliances; what is to be done

then? Tie the two limbs together tightly. Nature, you see, has provided a splint, namely, the other limb, which is always there; but it is only two or three years since it was discovered as of use as a splint, although it has been there all these thousands of years. It was a great discovery that, but I am afraid it was not the doctors who found it out. Supposing, however, the accident occurs in the street and not in the country lane, you will get plenty of people willing to assist, it may be misdirect and provoke you with their ignorant officiousness. Every one prides him- or herself on his or her knowledge of "these things," and curtails many a life by the belief. You must, if you have hold of the feet, not let go, but make other people fetch and carry; fetch a broom-handle from the nearest house, or apply umbrellas or walking-sticks if that cannot be got, and after that is fixed, and not till then, will the patient be in a fit state to be carried.

FIG. 28.—Broom-handle applied for fractured thigh.
(Another bandage round both knees should also have been figured.)

To fix a broom-handle, or the like, to a broken limb:—

(*a.*) Apply it along the outside of the limb, from the armpit to beyond the feet.

(*b.*) Tie the feet, including the splint, together as in figure 28. There is a hollow above the heels and behind the ankles where you can slip a bandage through without moving the limbs.

(*c.*) Pass a handkerchief, scarf, or triangular bandage behind the hollow of the knees, and tie the two limbs and the splint together tightly.

(*d.*) In like manner pass a bandage below (not beneath) the hips, where there is a hollow between the hip and the top of the thigh. Tie it firmly.

(*e*.) Round the body pass two bandages, one just above the hips, tying the pole to the haunch-bone, or pelvis, and finally pass a bandage round the chest just below the armpits and including the top of the splint. Do not tie your bandage round the belly, or abdomen; a compression here, with no bone resisting, may cause inconvenience or even damage. Tie the two limbs together.

The patient is now rigid and stiff from the neck to the heels, and as the bandages are tied over the ankle, knee, and hip-joints, there is no danger of movement. In this state the patient is now safe to be carried on a stretcher to his home, or a hospital, or placed in a van, waggon, or cart in which he can lie full length.

When the **bones of the legs** are broken, the same signs and symptoms are present as enumerated at page 214. The danger varies directly according as both bones or only one bone is broken. When both bones are broken, the fracture is generally the result of direct violence, such as the wheel of a vehicle, or of severe indirect violence, such as alighting from a great height on the feet. In either case both bones of both legs may be broken. Fortunately only one bone is usually broken, and that bone is generally the outside small splint-bone, the fibula. Even supposing the shin-bone, or tibia, is broken alone, it is easy to see the advantage accruing from having even the small bone of the leg unbroken, as it prevents much displacement, prevents the bones twisting or falling backwards or forwards, inwards or outwards, and thereby endangering the blood-vessels. You know, or ought to know, had you read carefully at page 52, the danger of allowing the patient with a simple fracture to move; and here the same troubles may ensue, only ten times more likely is a simple fracture to become a complicated or compound if both bones are broken in place of one. The sound bone acts as a splint to its fellow, and prevents so much mischief resulting. The most commonly broken bone in the leg is the *fibula*, and it is broken usually about four inches above its lower end. Its lower end is easily recognised just beneath the outside elastic of

the boot, and the bone can be traced upwards until it disappears in the calf of the leg.

This fracture goes by the name of Pott's fracture. The story is told of how Percival Pott, a surgeon to St. Bartholomew's Hospital, fell on London Bridge. He felt he had broken his leg, and, knowing the consequence of allowing the unskilful to touch it, he placed his back against the parapet of the bridge, and with his stick kept the Good Samaritans off, until a stretcher and skilled hands were brought from the hospital. Whilst lying up with this accident, his attention was directed to the exact nature of the fracture, and from his time the fracture has been called Pott's.

It is frequently mistaken for a sprained ankle, and very often is it the case that the doctor is not called in until after a week or fortnight, when poulticing or arnica lotion has had its try. To make out the fracture, apply the rules laid down in page 214 as guides, and especially notice that the foot is misplaced and twisted outwards. The toe is not in a line with the kneecap and shin, as it naturally is. It requires no training in anatomy to know the appearance of a sound limb, and the least suspicion of any change of shape becomes immediately apparent.

What is to be done with a broken leg-bone or bones? Follow the lines of treatment laid down on page 217:—

1. Secure the feet; get them in apposition; and tie them together.

2. Apply a splint, *i.e.* an umbrella (Fig. 30), a walking-stick, a piece of matting, a folded coat, a policeman's truncheon, the sheath of a sword, a bayonet, a bundle of straw rolled up as in Fig. 29, a goal-pole or a broom-handle broken in two.

The splint for a broken leg should be long enough to go from above the knee to beyond the foot. When only one umbrella can be had, apply that along the outside and lash the other leg to the inside (as in Fig. 30), where all are tied together; where two umbrellas can be had, put one inside, the other outside, and tie them to the injured leg, finally end off by tying the two legs together at the feet

and knee. Policemen carry with them the means of rendering aid in such cases; two truncheons are placed, one on

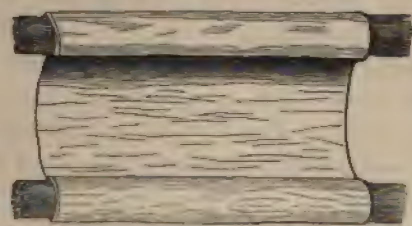


FIG. 29.—Improvised splint of two bundles of straw or twigs rolled in cloth, canvas, or the like.

one side of the limb, one on the other, and the band they wear on the left coat-sleeve just above the wrist, when on duty, is long enough to pass round the limb and fix the truncheons —one band fastened just below the knee, the other at the ankle; finally, the feet and knees ought to be tied together with a handkerchief or strap before moving the patient.

3. Bandages must be applied, one round the feet, another above the fracture, a third above and a fourth round the knee and thigh to check movement.

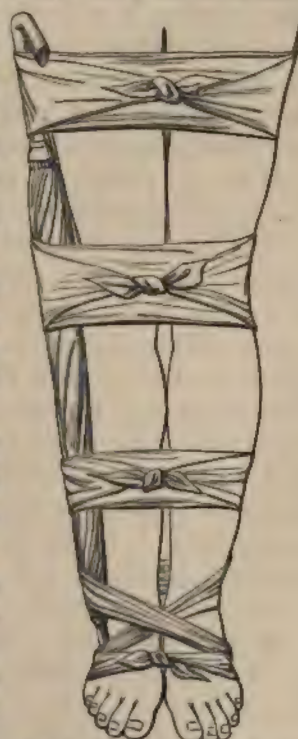


FIG. 30.—Umbrella employed as an improvised splint in broken leg.

A broken Kneecap (patella) is a very common accident, and until the last few years one from which there was no permanent recovery. The patella forms the front boundary of the knee, and consequently when it is broken the knee-joint is opened. As already explained (page 213), it usually takes place from muscular violence, *e.g.* in the act of jumping, when the muscles, proving too strong for the bone, snap it across its centre. The limb

becomes helpless; there will be no shortening, but the gap can be felt with the finger, and the joint will swell up almost at once. Motion must be prevented, and this is to be done by simply applying a splint, *e.g.* umbrella, along the back of the limb, or a couple of umbrellas, one outside and one inside the limb. If nothing is procurable in the way of a splint, the two limbs tied together will prevent mischief.

We must now briefly consider fractures of the bones of the trunk.

A broken Haunch-bone (pelvis) is a fairly common accident, but it is at times very difficult to make out, even for medical men; and it is beyond my power to make it plain enough to you for it to be worth our while discussing it fully. Suffice it to relate: that the patient complains of great pain in the region of the haunch-bone; that he cannot get up; that his lower limbs on examination prove all right; and that he is suffering from much shock (see page 236); then give the patient the benefit of the doubt, and treat him as though his pelvis were broken. Of course, if on applying your hand on the bone you made out grating, or crepitus, you would at once know that a fracture had taken place. Do not, however, move a broken bone about in the search for crepitus. In this particular bone the organs within the pelvis are vital, and a tear or bruise of one or other of them by the jagged edge of the broken bone might lead to fatal consequences. Give the patient the benefit of the doubt, and keep him rigid by long splints (and you know now what I mean by these) applied along both sides of the body from the armpit to the heels. These are to be tied firmly to the body and lower limbs by numerous bandages, and in this state the patient can with more safety be removed.

Broken Ribs are of frequent occurrence, and require "first aid" to be skilfully rendered, just as do other bones. Broken ribs are not of so much consequence of themselves, but it is the tender and vital organs with which they are in contact that render them dangerous to life. A rib, when broken, is in the very best condition as regards itself, for has it not a rib above and another below to act as splints

and keep it in its place? But with all that a broken rib has a drawback which no other bone has, and that is, you cannot keep it quite quiet. The patient must breathe to live, and the ribs must consequently move with the motions of the chest. Now the organs which may be injured when a rib, or rather ribs, are broken, are the lungs, the liver, the spleen, and even the stomach or heart; in fact, all those organs (see page 174) which nestle for protection under the cover of the ribs. All these organs are vital, but the lung, which is the most frequently injured, is fortunately the least so. When the lung is torn there may occur internal bleeding, with or without the coughing-up of blood. Blood brought up by the mouth may come from either the stomach or lungs; when it is *from the lungs the blood* is coughed up in mouthfuls, it is scarlet in colour, frothy from mixture with the air and fluid in the air passages; when it is *from the stomach*, the blood is vomited up in quantity, it is dark in colour, it is not frothy, but is thick and lumpy from the action of the juice of the stomach—the gastric juice.

To treat bleeding from the lung:—

1. Open the window so as to allow the patient fresh cold air to breathe.

2. Keep the patient absolutely quiet in the position of repose.

3. Give ice to suck if it can be procured, if not let the patient sip cold water, vinegar and cold water, or, better still, a strong solution of alum and water, or strong cold tea; the latter with a lump of ice in it, if it can be had, is an excellent and fairly efficacious remedy.

It may happen that bleeding may occur internally, with no evident signs except those due to loss of blood. This may arise from a broken blood-vessel in the chest or abdomen, the result of disease, a broken bone, a stab, or bullet wound. That some serious internal injury has taken place may be judged from the giddiness and pallor which speedily supervene, and the faintness which comes on when the patient attempts to stand up, or is propped up in the sitting posi-

tion. The breathing becomes short, and the heart fluttering. Nothing will save the patient if a large vessel has burst, but if it is one of secondary size (and you cannot tell which), keep the patient almost flat, absolutely quiet, and give some of the simple remedies recommended at page 75. When a rib is broken it is essential, of course, to attend to the bleeding first and foremost; you do this whether the blood is coughed up or whether you suspect from the symptoms that bleeding is going on into the cavity of the chest (see above).

To keep the rib quiet would mean binding the chest so tightly as to impede breathing, and to force the end of the rib further into the lung, and thus to cause evil instead of good. **What you do is this:** You take a broad folded bandage,—for instance, a triangular bandage folded twice,—and, applying the centre of the bandage over the spot the patient complains of (and that is the injured spot), pass the ends round to the opposite side of the body and tie them there so as to give support and comfort to the patient. Ask the patient as you gradually tighten the bandage if it is comfortable, and the sigh of relief the patient gives when the bandage is sufficiently tight indicates at once when to stop.

The same purpose is answered by swathing the chest tightly in a jack-towel, and fixing it firmly by sewing. It is safer, if you can get it, to take a piece of plaster—diachylon plaster—and strap it round one side of the chest. The piece of plaster should be taken as long as from the spine to the breastbone, and as broad as the palm of the hand of the patient on whom it is to be applied. Warm the strapping-plaster before the fire, and, fixing it at the backbone behind firmly to begin with, pull steadily and gradually, applying the plaster over the painful part, *i.e.* the broken rib, and finally end it off at the middle line in front. You will at once understand the advantage of this when you see that only one side is bound up; the other, the sound side, is allowed freedom to move with the breathing.

The Bones of the Upper Extremity which are most frequently broken are the collarbone, the bone of the arm, and the bones of the forearm, more especially the radius.

Fracture of the Collarbone, or clavicle, is an accident of every-day occurrence, and one to which it is essential to know how to render first aid.

For an account of the collarbone, its S-shaped curve, its position, and its likelihood of being fractured, see page 175.

It is a frequent accident in the football field and in the hunting field, whilst in the nursery it is not an uncommon occurrence when children are learning to walk.

The bone has to sustain the whole weight of the body when one falls on the hand; it may happen that both collarbones are broken at once.

When fracture does take place, it can be made out by applying the rules and tests laid down in page 214. Especially marked is the helplessness of the limb, the patient generally supporting the injured limb at the elbow with the other hand; deformity can be seen when the collarbone is looked at and compared with its fellow; and the gap or crack may be felt with the finger. On pushing up the elbow most of the deformity will disappear.

To prevent the end of the bone coming through the skin, *i.e.* compound fracture, or going into a blood-vessel, *i.e.* complicated fracture, it is necessary to fix the limb quickly and firmly. To effect this there are well-nigh as many means as there are doctors in the country; for "first aid" purposes, however, a speedy, sure, and safe method is the following: Place a pad in the armpit of the injured side; the pad may be a newspaper folded firmly, a handkerchief with a ball of worsted in it, a tennis-ball wrapped in a scarf, a lady's shoulder-wrap, a waistcoat folded to a square shape, and so forth. Place this in the armpit, pushing it gently but firmly upwards. Whilst this is held, apply a larger arm sling (see page 212), and finally tie the limb to the side as represented on next page. Were I to tell you other methods, it would only

confuse you when the time comes for application in real injury.

But, one naturally asks, Where is one to get triangular bandages on the hunting field? Well, a large handkerchief or neckerchief will do as well; but if that is not to be had, fix the arm to the side by a couple of handkerchiefs knotted together and tied round the body, including the arm; and turn up the tail of the coat or jacket over the forearm and pin it to the breast of the coat. Thus is a sling improvised which will serve to keep the limb quiet until you get something better. If the accident happens on the hunting field,

FIG. 31.—Bandage for broken collar-bone after Esmarch.

the patient should not be allowed to ride home, especially if it is the left clavicle which is broken. The patient should be taken to the nearest doctor in all cases, and most certainly should "his own doctor" be sent for when he gets home. You must not think, when you have rendered "first aid" in a case of fracture, that you can dispense with the doctor. Be as clever as you may at fixing a bone according to the instructions given you, and even should the doctor not want to touch it, which he will not if you remember and act upon the rules I have told you, still, for all that, there are other things to consider

when a bone is broken. The shock to the system will require attention; from this upset the patient may become the subject of any latent disease, such as gout, rheumatism, kidney disease, and numerous other ailments, which are much more likely to lead to serious trouble than the simple break of the bone. It is not knowledge, but ignorance, that makes people doctor themselves; and the most ignorant are in this, as in other things, the most ready to take upon themselves the management of even human lives. A man may ruin his own health—there is no law to stop him; but he ought not to be allowed to inflict hopeless ruin upon the health of others by his ignorant help.

The Bladebone (the scapula) is but seldom broken; when it is, it generally happens from a crush, or being hit by the buffer of a railway-carriage; it is not an uncommon accident amongst railway-servants. When it does happen, fix a bandage round the chest, just below the armpits, so as to embrace the bladebone, and apply a sling to support the arm.

The Arm-bone (the humerus) is frequently broken, and by a multiplicity of causes. The fact of its being broken can be established by a study of the signs and symptoms given at page 214. When broken at its upper end the signs may be obscure; but if, after a fall, the limb hangs helpless, and the patient complains of great pain on movement, then treat it as in fractured clavicle, by placing a pad in the armpit, tying the arm to the side, and putting on a smaller (not a larger) arm-sling, *i.e.* one folded twice.

When it is broken near its lower end, the fracture is usually perfectly apparent, and for this, as in the case of fracture of the elbow or forearm, make a splint of two pieces of stick crossed and tied together by a handkerchief, as represented at page 228. This splint is to be applied to the inside of the limb, and tied on with one handkerchief round the arm, another one, or two, round the forearm; and the limb is to be supported in a sling. Such a splint as this may be made of two pieces of wood—be they flat or round; of two pieces of cardboard; of two pieces of bonnet-

box; or of folded newspapers with pieces of wood, such as those used for lighting the fire, wrapped up in them to give fixity.

When the arm-bone is broken, and such a splint as this (Fig. 32) is to be applied, enclose the front, back and outside of the arm as well in a piece of stiffly-folded newspaper, or, instead of newspaper, a notebook applied open, or the straw casing used to pack bottles, such as champagne bottles, a piece of cardboard, or anything that comes handy. Supposing one is some distance away from assistance, a walking-stick may be broken in two, the ends crossed, as in Fig. 32, and tied together with a handkerchief, and applied to the inside of the arm as a splint;

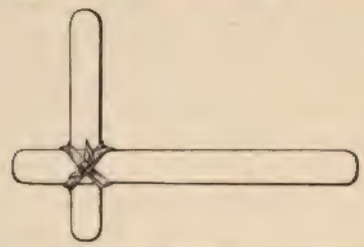


FIG. 32.—Improvised angular splint for fractures of upper limb (Author).

the coat-sleeve may then be pinned to the breast of the coat or dress, or the tail of the coat or jacket turned up and fixed as described at page 226. The bough of a tree may supply the place of a stick; two bayonets crossed, or the sheath and the bayonet crossed, may be tied together as in Fig. 32. That person must be stupid indeed who cannot in an open field, and away from everything, as the saying is, find a means of fixing a broken limb. If you can do nothing else, you can tie the arm to the side with handkerchiefs; and if even these are wanting, you can pin the coat-sleeve to the side—it is better than letting the arm dangle.

When a **fracture of both bones of the forearm**—the radius and ulna—occurs, there is usually not much difficulty in making out that the bones are broken. Almost all the signs and symptoms mentioned at page 214 are present.

To fix the limb, apply the splint delineated at Fig. 32, along the inside of the limb; in addition place a piece of stiff substance, such as a newspaper, matting, the straw casing of a bottle, a book with soft covers, or a piece of wood, along the outside of the forearm; and support by a sling.

Attend to the following injunctions when either the bone of the arm or the bone of the forearm are broken :—

1. Keep the elbow bent at a right angle.
2. Keep the thumb upwards towards the ceiling.
3. Fix in splints and support in a sling.

The rule in the upper extremity is to keep the elbow bent, in the lower to keep the knee straight. The objects are obvious. Should the patient recover with a stiff knee, the limb would be in a straight position and useful for progression, whereas a bent position would necessitate the use of a wooden pin to walk on. So with the upper limb: should the elbow recover fixed in a straight line after an accident, the hand could not be brought near the mouth; whereas in a bent position, with the thumb upwards, the hand can be used for feeding and for writing purposes, &c.

There is a special, very common fracture which occurs at the lower end of the forearm, in the bone that supports the hand, *i.e.* outside bone, or radius (see page 179). It is one of the most common fractures in the body, and goes by the name of Colles's fracture. It is peculiar inasmuch as it does not belong to any of the varieties of fracture previously mentioned. The cause of its occurrence is simple enough: a fall on the hand; and this bone which supports the hand—the radius—may snap through just above the wrist. Before the broken ends of the bone can escape from each other they are driven the one into the other, so that they are firmly fixed or impacted. This is called an *impacted* fracture. It may occur in other parts of the body, notably the neck of the thigh-bone. It is evident that all the signs given at page 214 will not be present in this form of injury. When it occurs, there will be pain and some deformity, but it will require skilled medical examination before it can

be made out. The treatment is to fix the limb as comfortably as possible in splints, as described for the arm and forearm, apply a sling, and take the patient to the nearest doctor. When a **finger-bone** is broken, apply a stick, or a piece of kamptulicon, along the palmar or front face of the finger, and fix with strips of your handkerchief or a piece of plaster.

Still another fracture of importance to be mentioned is—

Fracture of the Lower Jaw.—The lower jaw-bone is apt to get broken by a blow, a kick from a horse, a fall on the chin, &c. When it is broken the fact is easily ascertained, as the signs of fracture (see page 214) are evident. The mouth cannot be closed, the teeth are uneven, blood escapes into the mouth, the gap can be felt outside, and the grating, crackling, or crepitus can be felt on the least motion. Nature has provided a splint to which to bandage it, namely, the upper jaw, against which it naturally lies. To fix it, tie a handkerchief round below the jaw, cross the ends on the top of the head, and tie below the chin; a second handkerchief carried round the front of the chin to the back of the neck and there tied will secure the jaw firmly (see page 212, Fig. 25). Consult the doctor as to the means of feeding the patient and further treatment.

The Management of the Clothing in Street Accidents.—Your greatest difficulty in street accidents of the nature of broken bones or cut arteries is to know what to do with the clothing. Authorities on "first aid" say you are to rip up the clothing. Now this takes time; even with a sharp knife or scissors it takes you more time than you would care to spend, if it is a case of bleeding from the top of the thigh or armpit. The rule is, when you can make out what is the matter—say a broken leg or arm, or even have strong conviction that a bone is broken—do not pull the leg about by ripping up the clothing, and perhaps making the accident compound, but fix your splint outside the clothing, and *proceed as if the clothing were off.*

In the case of bleeding you can compress all the vessels above the clothing easily, except the artery behind

the collarbone and the artery at the fold of the groin Unfortunately, it is when these two have to be compressed that most speed is required, owing to the large size of the vessels wounded. If you wait until the clothing is slit up, the patient will have likely bled to death, so you should proceed as follows :—For the artery of the thigh press your thumbs at once (as directed, page 194, Fig. 8) on the region of the artery above the clothing, and let others slit it up. In a man or boy the compression can be done above the clothing when the patient is laid down flat. In the case of a female it is impossible, but a wound of the artery high up in the thigh in a female is an extremely rare accident.

To compress the artery behind the collarbone, for a wound of the artery in the armpit, at once tear off the collar and scarf, and get your thumb in "the bird's nest," over or under the shirt, according as you can get it off or not. Let others then slip the clothing off.

Broken Back.—If the spine is broken, say in the middle of the back, the spinal cord (see page 182) is apt to get torn. The consequence is easily understood now that you know the relation of the spinal cord and nerves to the motion and sensation of the body, and to the backbone itself. In the case we have cited all sensation and motion would be lost below the spot where the rent of the cord has taken place —that is, the part below would be paralysed. The danger from the backbone being broken is not so much on account of the mishap to the actual bones as it is to the parts contained within. When the patient cannot move the lower limbs after a cart-wheel has gone across his back, you may come to a pretty safe conclusion as to the real facts. If, then, it be important to attend to a person where he falls in other cases of fracture, it is more important a hundredfold in such an accident as this. In fact the patient should not be moved, if you can help it, until a doctor is fetched ; but if it is impossible to get a doctor within a reasonable time, you must take great care to keep the patient's body rigid by poles, broom-handles, rifles, and such like, fastened on either side of the body. Beneath him a blanket or sheet should

be half slipped, half dragged, so as to be spread beneath him from shoulders to heels without moving his body.

When raised on the blanket or sheet by four people lifting at the four corners, pass a shutter (or stretcher, if you can get one from the police or hospital or ambulance station), under the patient, laying blanket and all on the stretcher. He can then be carried in safety. When the fracture is high up in the neck, the patient dies at once from a broken neck, as it is called. This is because the nerves to the midriff, or diaphragm, the muscle essential to breathing and consequently to life, receives its nerve supply by two nerves, the phrenics, which come off high up in the neck. Their influence is stopped; hence the diaphragm ceases to act, and death instantly ensues.

Having told you the meaning and nature of an injury to the spinal cord by a broken backbone, I must now explain

Injuries to the Brain.

1. **From Fractured Skull.**—The limits of the brain have already been given at p. 180. It is there stated that the position of the brain is limited by a line drawn from where the hair joins the nape of the neck, forwards and along the side of the head, and across the ears to the eyebrows. All above that line contains brain, and the brain is contained in the cranium. Any blow or fall on the head is apt, therefore, to cause a piece of *bone* to be depressed, to press on the brain, and to cause **compression.**

Compression may also come from *blood* pressing on the brain, and this condition arises thus. When a severe blow on the head is received, the rupture of a blood-vessel within the cranium may occur. The blood escapes from the artery and gradually accumulates between the bone and the brain. It may accumulate in such quantity—after, say, twenty minutes or half an hour—that it will press upon the brain, and cause compression just as surely as does a piece of bone. Compression may thus arise in two ways: the one, from bone, comes on immediately; the other, from blood, comes

on after the blood has had sufficient time to collect, say twenty minutes, during part of which time the patient may have been stunned. How to recognise compression of the brain :—

1. The patient is insensible.

2. There is loud snoring, called stertorous breathing—this is caused by the soft palate being relaxed and flapping backwards and forwards in the throat; the muscles of the larynx are relaxed; the cheeks are puffed out and dragged in between the jaws during expiration and inspiration respectively.

3. The eyeballs are insensible to touch. This marks deep insensibility, as you might expect, when the tender eye, in which a speck of dust cannot alight without your becoming aware of it, allows you to touch it.

4. The pupils of the eyes become insensible to light. The pupil of the eye is the black circle in the centre of the eye, situated in the middle of the blue, grey, brown, or black iris. The pupil in health is contracted when in a bright, and dilated in a shaded, light. The degree of insensibility can be partially judged when, by holding a candle before the eyes, or opening the eyelids in bright sunlight, it is observed whether the pupil contracts or not. If it does not, or but slowly and imperfectly, then is the injury to the brain great and the insensibility deep.

5. The hand placed over the heart, or the finger placed upon the pulse at the wrist (page 201), will indicate a slow action and a threatening to stop.

This condition might be mistaken for apoplexy or drunkenness. The mistaking it for apoplexy would not signify, as the treatment of the two conditions is well-nigh the same, and the history of the fall would settle the question (see Apoplexy). The mistaking it for drunkenness may be more serious (see Drunkenness). When there is any doubt, give the patient the benefit of it, and treat him, not as a drunken man, but as one having met with an accident.

What is to be done in compression? Send for a doctor at once. In the meantime—

(*a.*) Place the patient in such a position that the air may readily enter his nose or mouth, and wipe the mud, or froth, or blood from off his nose and mouth.

(*b.*) Undo all tight clothing about the neck; undo the neck-cloth, shirt-stud, braces, waistcoat, and anything too tight around the waist.

(*c.*) Keep the head up in a line with the neck and shoulders, in the position of repose. You must beware how you hold an insensible person's head up; unless you notice what you are doing, you will find that the head is bent so that the chin is on the chest, and the patient well-nigh, or actually, suffocated from your want of attention. Again, you may, by passing your hand behind the lower part of the neck, in the endeavour to raise the shoulders, allow the head to fall back, and your attention is recalled by the gurgling sound in the patient's throat. The patient must be in a position to breathe easily.

(*d.*) Keep the windows open if it is in the house you are attending to an insensible patient; if in the street, endeavour, but you won't succeed, to keep the crowd away.

(*e.*) Apply cold water, or ice if you can get it, on a handkerchief or sponge to the head. This is most likely to do good when blood is escaping; but do it in any case, as you cannot be sure as to what has happened.

When the patient is taken within doors, take off the boots and apply mustard leaves or a mustard plaster to the soles of the feet.

II. A more common accident to the brain is one in which the patient is said to be **stunned** or **concussed.** This is brought about by a severe blow on the head, causing the brain to be so shaken that its workings stop, and the patient becomes insensible. As when you drop your watch, sometimes the glass is broken, at other times the works stop—so with the brain and skull, sometimes the bone is cracked, at other times the works stop. In simple concussion no real injury may have been done to the brain. It is only temporarily deranged; it will go on working by and by.

How can you recognise concussion?

(*a.*) There is the fact of a blow—a fact made evident, it may be, by a bruise or cut.

(*b.*) The patient is insensible.

(*c.*) The breathing is so quiet that you have to listen carefully, or put your hand on the chest to make out the rise and fall of the chest. This is very different from the loud snoring in compression.

(*d.*) The heart and pulse are disturbed, so that you get a flickering, fluttering beat.

(*e.*) The pupils may, on pulling the eyelids up, be seen to contract to light, or remain fixed, according to the depth of the insensibility.

The unconscious state may last from a few seconds to many minutes, or even hours.

Of course, in all injuries to the head, such as compression from bone, or rupture of an artery leading to effusion of blood, concussion will play a part—that is, the brain will be shaken. When the insensibility is from depressed bone, the symptoms of compression will come on at once, and drown those of concussion. When, on the other hand, the injury results in effusion of blood, at first there are symptoms of concussion, which after a few minutes may disappear, consciousness may return, the patient be able to tell his name, and whilst he is speaking and insisting on going home, the blood, which all the time has been slowly accumulating, may have gathered in such quantity as at the end of twenty minutes to press on the brain and cause compression. The train of symptoms from first to last would be—(1) insensibility, with placid breathing—concussion; (2) consciousness; (3) insensibility, with loud snoring—compression.

This paragraph will require reading again, as it is a summary of the facts of the few previous pages.

What is to be done when a person is stunned or concussed?

Send for a doctor—but in the meantime:

(1.) Place the patient in an easy position to breathe.

(2.) Undo all tight clothing everywhere.

(3.) Keep the windows open, if in the house.

(4.) Attempt to keep the crowd off, if out of doors.

(5.) Smelling-salts to the nose will do no harm, nor tickling the nose with a feather; but the brain will not go on working again until it has settled down from its shake. The application of cold water to the head may be advantageous.

Shock.—By shock to the system is meant the physical condition that a person is thrown into after a severe accident. It matters not how slight the accident, still is there a slight shock to the system; a rap on the knuckles, a barked shin, burning the finger whilst lighting a match, will each and all give rise to slight shock. If, on the other hand, the injury be severe, then is the shock great; a broken leg, a severe burn, a blow on the abdomen, will one and all give rise to severe shock.

Supposing a man pitched off his van, and you find him in the street or the side of the road with a broken leg. The first thing you will notice is, that he is shivering, and seems cold, even although it be twelve o'clock on a hot day in July. You will also find that the man is sensible; he can tell you how the accident happened, and he *tells* you he is cold; you see there is nothing wrong with his brain; it is his leg that is injured, not his brain. When you put your hand upon him, his skin feels cold. This is, then, a characteristic feature in shock, namely, a lowering of temperature. The temperature of the body in health remains pretty constant, falling a little in the early morning, rising a little in the early evening, but practically it is at what you see marked on the ordinary wall thermometer as "blood heat." When you read off the number on the thermometer scale, you will see that blood-heat stands opposite 98°, and that is about the average temperature. In fevers the temperature goes up to say 105°, or even 110°; but in the condition we are speaking of, shock, it falls to, say, 95°, or even 92°.

Here, then, is the indication of your treatment of shock,

viz. to prevent the man dying of cold. So in this and in all accidents your attention must be directed not only to fixing the broken leg, but also to keeping the patient warm. To do this, throw any wrap you have with you, or can obtain from the bystanders, over the patient. Get a blanket from the nearest house, if you can; but if you can get nothing else, divest yourself of your coat or shawl, and throw that over him.

When you get the patient under shelter, throw a warm blanket or blankets over him. He will stand two or three. Give him some hot tea, coffee, or milk, or a small quantity of hot whisky and water. Get ready hot bottles to apply to the feet, and in every way you can, consistent with common sense, keep the patient warm. You will in this way prevent the body heat falling too low, and so render recovery possible.

Fits.—It may be impossible to prevent fits coming on, but it is possible, once they have come on, by intelligent and common sense rules, to prevent more serious consequences ensuing.

There are many forms and varieties of such diseases, but only the more common will I tell you of. There are three chief forms :—

I. **Epileptic Fits.**—The disease, which in ancient times was called being possessed by a devil, is in modern times called epilepsy. It is characterised by a sudden seizure, in which the patient gives usually a cry or shriek, and, falling down, goes through a series of twitchings and contortions of limbs, body, and features, caused by muscular spasm. The muscles move the jaw and the tongue, but these do not keep time in their actions, and the tongue gets caught between the teeth and bitten. It is not that the patient bites the tongue in agony, it is only that the tongue gets as it were accidentally caught between the teeth.

Treatment: You cannot shake the patient out of the fit, you can only, *whilst the fit is on* :—

1. Undo all tight clothing about the neck.

2. Place the patient in the position of repose, so that the breathing is in nowise hampered.

3. Prevent the tongue being bitten by placing a cork, the handle of a pocket-knife, a pencil, a piece of india-rubber, or your handkerchief twisted, between the teeth.

4. Restrain the struggles, but do not tie the patient down or put heavy weights on his limbs, so as to violently oppose the spasm.

5. Take care that the patient does not hurt you or him- or her-self whilst struggling.

6. *After* the fit allow of three or four hours sleep. The fit is only the expression of the diseased condition, medical advice will have to be sought, and that too for a lengthened period if any permanent good is to be done.

Every one subject to epileptic fits ought to avoid alcohol, to shun dangerous places, such as the edges of pits, cliffs, and so forth, and should never if possible be alone.

II. **Fainting Fits** come from the effects of a close room; tight lacing; fright, as at the sight of blood; good or bad news of an affecting nature, and so on. The fit comes on generally with a feeling of giddiness and fluttering at the heart; the face becomes deadly pale; the blood deserts the lips; the patient becomes insensible and tumbles down. Supposing you are sitting in church, and you find the person next you *going off* into a fit, you should at once bend the head low between the knees. Supposing the person has gone off into a dead faint, and the first thing you hear is the head thump against the pew, then lay the patient down *flat* on the seat. When I say *flat*, I mean flat; so make no mistake. Do not raise the head, but rather let the head be below the level of the body over the end of the seat. Fussy people will raise something, it is in human nature to do so; well, let that fussy person raise the *heels*, it will do some good. Now the object of pressing the head between the knees, or laying the patient down flat, or even with the head below the level of the body is to get the blood to go to the brain; and so by getting the head on to a level with or even below the heart, it is fairly

to be expected that the blood will circulate more freely in the brain. When the circulation is restored, the patient will recover affrighted, but not seriously worse for the short spell of insensibility. The patient should, when sensibility is restored, be removed into the open air—at any rate out of the place where the faint occurred; otherwise, the same conditions obtaining, the faint may come on again. Smelling salts applied to the nose may ward off a faint, or may help to bring the patient round when insensible. A draught of cold air in the face, or smart sprinkling with cold water may cause the patient to breathe, and so cause the blood to circulate freely. Cold air is very likely to do good, as it was coming suddenly into contact with the cold air which made us take our first breath, and we have gone on breathing ever since.

III. **Hysterical Fits.**—Hysteria is a disease which exhibits itself in the form of more or less frequent fits. These fits are peculiar: the patient (a girl generally) never faints by herself; she never falls to hurt herself; and she can have these fits when she pleases. The fit is known by its violence—by kicking, screaming, howling, tearing, biting, and such-like acts. The eyelids twitter and blinter, and the parents of a hysterical girl generally regard this as a sign of fearful import. She is blintering to see what the bystander means to do; if it happens that the bystander knows what to do, the girl will soon recover when she finds the necessary steps are being taken. The steps are, pouring a jug-full of cold water slowly on the head, or dashing a tumbler-full of cold water sharply in the face. This, with some *un*sympathetic talking to, will likely suffice to bring her round. Not a bad plan is to go out of the room, slam the door, and make the patient believe you are gone away. Quietness will soon ensue, and the fit will go off if you make no noise whilst outside the door; but if the patient knows you are there, the fit will not stop, but only continue in its intensity. Medical advice must be sought before the disease is cured.

Bite from an animal.—We are more often in this country

bitten by dogs than by other animals, but it matters not what animal bites one, be it a horse, a snake, or a man, the same rules apply in every case. It matters not whether the dog is known to be mad—that is, rabid—or not, you are to proceed as if it were. It is most dangerous to get bitten on the hand and face, not that there is anything peculiar about these parts, but that they are the only parts not covered by clothing. The dog's teeth are not the poison, it is the fluid, the saliva, which is on the dog's teeth, which when it gets into the blood may set up hydrophobia. The teeth, in other parts than the face and hand, get wiped as they pass through the clothing and go in clean and possibly freed from the rabid poison.

Supposing the finger bit at its point, proceed as follows: (1) At once grasp the finger above the wound, between the fore-finger and thumb of the other hand; (2) suck the wound; (3) rush to the water-tap and let water flow over the wound, but do not relax your grasp on the finger; alternately suck and wash for five or ten minutes, or, better still, dip the finger in warm water instead of cold, it will encourage bleeding and thus help to expel the poison out of the wound. (4) If you know the dog to be mad, you should tie a string round the finger above the wound, *i.e.*, between the wound and the heart, when you can relax your grasp with your finger. Go to a doctor and get him to cauterise it for you, and then act afterwards as he directs. Supposing one is far away from a doctor or chemist, one may cauterise by a red-hot wire, or by pushing a lit fusee or vesuvian into it. Sportsmen in India have been known, when bit by a snake, to pour gunpowder on the part and explode it.

THE STING from a bee or a wasp is to be treated in the same manner. You pick out the sting when you see it.

Notice that any of these poisons may be sucked with impunity, if you have no crack or abraded part about the mouth; besides, one does not swallow the poison after sucking.

If, of course, one is bitten or stung in other parts besides

the finger—if it is the hand that is bitten, tie a handkerchief tightly round the wrist, and then proceed as before; if it is the face you must dispense with the bandage and trust to sucking, &c. Whenever you can, you tie a ligature between the wound and the heart, suck, wash, and cauterise, and go to a doctor speedily. The object, instantaneously it must be, of tying a band between the heart and the wound is to stop the passage of the blood in the part, and so prevent the veins carrying the poison away into the circulation.

A mad or RABID dog suffers from a disease called RABIES. The poison is present in the saliva, which when it finds its way into the blood of man causes the disease called hydrophobia. A rabid dog is a diseased animal, and looks and behaves as though he felt ill and nervous; his coat is out of condition; his ears hang down; his eyes are red; he has a slouching gait; his tail has a droop instead of a curl upwards; he is nervous about crossing the street, and hesitates to leave the railings and the doorways; he avoids sunlight, and gets into the dark places in a room. The saliva dribbles from his mouth, and he has a spasmodic action in the muscles of his jaw. This causes him to snap at things without meaning harm, as it may even be a door scraper he gets hold of; and if you put down your hand to pat him he may, instead of licking, bite it. A friend attempting to pacify the animal gets served likewise; this will cause an alarm to be raised, the neighbours will collect, the dog becomes scared, frightened and provoked, is hunted with brooms and pitchforks, and is driven raving mad. This is the state we read of in the newspapers, and people imagine that all mad dogs behave like the "newspaper dog." The above description will show that far other is the case, and that a rabid dog may be quite quiet or quite harmless if not tormented or tampered with. Beware of dogs then which, in the hot weather, look out of condition and have a frothy saliva dribbling from their mouths; do nothing to provoke them, otherwise serious consequences may ensue.

Apoplexy.—This is a disease much dreaded and often

talked of, and one which seems now to occur in younger people than formerly. So far as we are concerned it is only with the apoplectic fit or seizure we have to do. The disease consists in the escape of blood on the brain from a broken blood-vessel. As we get older our blood-vessels, instead of remaining the soft elastic tubes they were in youth, become more brittle from lime-salts deposited in their walls; they are said to become bony. This inelastic narrowed condition of the vessels gives a great deal more work to the heart; consequently the heart, being a muscle, gets bigger, as other muscles do when much used. This big heart, thumping away against a diseased vessel, may, when extra work is thrown on it, as running, cause the vessel to crack and allow of the escape of blood. This may occur anywhere in the body, but when it does so in the brain it causes apoplexy.

In a well-marked apoplectic fit you would expect to find the symptoms of compression (page 233). There would be —(1) Insensibility beyond the power of rousing. (2) Loud snoring respirations—stertorous breathing. (3) The face would be flushed and congested. (4) The pupils possibly unequal, not responding to light. (5) The heart would be beating pretty strongly; that is part of the cause of the trouble that the heart is too strong. (6) The limbs upon one side of the trunk would be more limp than the other, pointing to which side is affected. It may be also that the temperature of the body is higher. (7) Usually the person is getting on in years.

Treatment: (*a*) Undo all tight clothing everywhere; (*b*) place the patient in an easy position to breathe; (*c*) open the windows, and pull the curtains of the window or bed well back if it is in the house, if in the street keep the crowd away; (*d*) keep the head up, with the precautions given at page 234; (*e*) apply cold water to the head on handkerchiefs, flannels, or sponges, or tie an ice-bag on the head. (*f*) Put hot-water bottles, mustard-leaves, or a mustard plaster, to the soles of the feet. If the doctor is far off, put one drop of croton oil, if you can get it, on a small lump of sugar

and insert it between the teeth. This may, by causing purgation, do some good. Never give any fluid by the mouth when a patient is insensible from any cause; in particular, guard against stimulants being given in apoplexy. For the differences between alcoholic poisoning and apoplexy, see page 253.

BURNS AND SCALDS.

Burns are caused by hot solid substances, or by flames; scalds are caused by hot fluids. A burn or scald may vary between a slight redness of the skin and complete charring of the tissues. Supposing a kettleful of boiling water to tumble over a child's foot, you would get off the shoe or boot as quickly as possible, cutting the elastic and leather, or cutting the lace and leather, if need be. You would then cut off the stocking along a dry part if there is one, so as to avoid sending your scissors or knife into the burned part. You must on no account *drag* the boot or stocking off, otherwise you will strip bare the injured part. When you see the part, there may be a big bleb or blister there; do not prick it, leave the doctor to be the judge of whether this should be done or not; but immediately place the limb in *warm* water, that is, water of the temperature of your own hand, or elbow. I tell you warm water, because that will be likely the fluid most quickly obtainable, especially if, as in this instance, there be any left in the kettle; the water excludes the air, is comforting if it is warm, and takes the pain away better than anything. Now get some oil—linseed oil, olive or salad oil, cod-liver oil, almond oil, *not* mineral oils such as naphtha or paraffin; and if you or your neighbours have any lime-water, take equal parts of oil, say linseed oil, and lime-water, and, mixing these together, you will get a thick honey-looking fluid, called carron oil. Into the oil, either plain or with lime-water, dip strips of soft rag or lint, and, taking the limb out of the warm water, apply the rags so as to completely cover the burnt part. Over this apply a thick layer of cotton wool, if you have got it, or flannel if you have not, and secure by gentle pressure with a bandage

or handkerchiefs. Place the patient with the limb in an easy position on a bed or couch, and send for the doctor, if you have not already done so. Instead of oil, one may use flour, common kitchen whiting, prepared chalk as used for tooth powder, either dusted on, or, better still, made into a paste, and then gently applied with a brush or feathers, making a covering about ¼ of an inch thick. If the pain is great, a strong solution of carbonate of soda in water may relieve it. Do not administer opiates if you can get a doctor within a reasonable time; but you should give the patient hot fluids to drink as he is suffering from shock, and requires in addition to the relief of the burnt part to be treated for shock (page 236). A person when burnt suffers not from high temperature, but from cold and chill, shock in fact, hence the necessity of immediately applying heat internally, and warm covering without.

If it is a burn, and part of the clothing is charred and stuck to the skin, do not drag it off, but take a scissors and cut the clothing off, leaving the part adherent to come off as it will. Otherwise the treatment for burns and scalds are practically the same. Take particular care of even slight burns on the throat and below the chin, such as occur when the clothes catch fire.

The Apparently Drowned or Suffocated.—When a man—of course it may be a woman or child—who cannot swim, falls into deep water, he generally rises once, twice, or thrice to the surface, and struggles to get a gasp of air or a grasp of anything near. The state of intense alarm causes forgetfulness, and an attempt is made to breathe below the water; the consequence is, water gets into the air passages and he becomes asphyxiated and insensible. Should he be pulled out of the water in time he may be restored by some one of the methods of artificial restoration. What do you mean by "in time"? In the first place it will be impossible to get a correct notion of the time he has been in the water from the bystanders: to some it will appear a long time, say twenty minutes; to others it may seem only five; so that

people may differ as much as fifteen minutes as to the time any person has been in the water. If it is an absurd time, say over half an hour, it would be useless to attempt to restore life ; but if there is a difference of opinion as to whether it was five minutes or fifteen minutes, begin to try to restore life at once. The directions given by the Royal Humane Society are here incorporated under the heading of the Sylvester Method of Restoring the Apparently Dead. There are other excellent methods, and chief amongst them, and by many preferred to the Sylvester method, is that of Dr. Marshall Hall. This is the best method if no assistant is at hand. It is performed by alternately rolling the body on its face to compress the chest, and on its back to allow the elasticity of the ribs free movement to draw air into the lungs The pressure of the hand over the lower ribs whilst the body is on the face, helps the process of expiration. Another excellent method is that of Howard ; but I am afraid that by telling you too many methods you will get confused by their complexity.

The Sylvester Method of Restoring the Apparently Dead, recommended by the Royal Humane Society.

If from drowning, suffocation, or narcotic poisoning :

Send for medical assistance, blankets, and dry clothing, but proceed to treat the patient *instantly*.

The points to be aimed at are—first, and immediately, the restoration of breathing ; secondly, after breathing is restored, the promotion of warmth and circulation.

The efforts to restore life must be persevered in until the arrival of medical assistance, or until the pulse and breathing have ceased for an hour.

Dr. H. R. Sylvester's Method of Restoring Natural Breathing.

Rule I.—To adjust the patient's position. Place the patient on his back on a flat surface, inclined a little from

the feet upwards, raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder blades. Remove all tight clothing from about the neck and chest.

RULE II.—To maintain a free entrance of air into the windpipe. Cleanse the mouth and nostrils, open the mouth; draw forward the patient's tongue, and keep it forward. An elastic band over the tongue and under the chin will answer this purpose.

RULE III.—To imitate the movements of breathing:

First. Induce inspiration. Place yourself at the head of the patient, grasp his arms, raise them upwards by the sides of his head, stretch them steadily but gently upwards, for two seconds.

[By this means fresh air is drawn into the lungs by raising the ribs.]

FIG. 33.—Inducing Inspiration.

Secondly. Induce expiration. Immediately turn down the patient's arms, and press them firmly but gently downwards against the sides of his chest for two seconds.

[By this means foul air is expelled from the lungs by depressing the ribs.]

Thirdly. Continue these movements. Repeat these

measures alternately, deliberately, and perseveringly, fifteen times in a minute, until a spontaneous effort to respire be perceived.

[By this means an exchange of air is produced in the lungs, similar to that effected by natural respiration.]

When a spontaneous effort to respire is perceived, cease to imitate the movements of breathing, and proceed to induce circulation and warmth (as below).

FIG. 34.—Inducing Expiration.

RULE IV.—To excite respiration. During the employment of the above method, excite the nostrils with snuff or smelling salts, or tickle the throat with a feather. Rub the chest and face briskly, and dash cold and hot water alternately on them. Friction of the limbs and body with dry flannels or cloths should be had recourse to. When there is proof of returning respiration, the individual may be placed in a warm bath, the movements of the arms above described being continued until respiration is fully restored. Raise the body in twenty seconds to a sitting position, dash cold water against the chest and face, and pass ammonia under the nose. Should a galvanic apparatus be at hand, apply the sponges to the region of the diaphragm and heart.

Treatment after Natural Breathing has been restored. —*To induce Circulation and Warmth.* Wrap the patient in dry blankets, and rub the limbs upwards energetically. Promote the warmth of the body by hot flannels, bottles or bladders of hot water, heated bricks, to the pit of the stomach, the armpits, and to the soles of the feet. On the restoration of breathing, when the power of swallowing has returned, a teaspoonful of warm water, small quantities of wine, warm brandy and water, or coffee should be given. The patient should be kept in bed, and a disposition to sleep encouraged. During reaction large mustard-plasters to the chest and below the shoulders will greatly relieve the distressed breathing.

NOTE.—In all cases of prolonged immersion in cold water, when the breathing continues, a warm bath should be employed to restore the temperature. An emetic will do good.

How to remove a foreign body from the Eye.—Do not rub the part; you will only press the substance if it be sharp and hard into the eyeball, and thereby do much damage.

Take hold of the upper lid and pull it forwards, and at the same time push up the lower lid inwards beneath the upper; let both go and allow them to rearrange themselves; the hair of the lower lid will brush the back of the upper lid, and may thus remove the foreign body. Do this once, twice, or thrice. This will usually remove the annoying smuts which find their way into the eye in a railway carriage. You can do it to yourself or others.

If you can get a basin of water, put your face into it and open and shut your eyes. Take a pinch of snuff if it can be got, the sneezing may help dislodgment. If none of these are of any use, pull down the lower lid and examine for the irritating particle on its inner side, if not there, examine below the upper eyelid. To do this get the patient to sit down, put a towel over the head, place the head back against your chest as you stand behind him; now press a penholder, or fine stick, or stout wire on the skin three-

fourths of an inch above the edge of the upper eyelid, and, pushing it back, seize the eyelashes of the upper lid, between the finger and thumb, and pull them forwards and upwards, everting the lid back over the penholder. You can thus examine for the foreign body and remove it if it is there. If you can see a piece of steel *fixed* into the clear part of the eye, drop in a few drops of olive oil, apply a little cotton-wool or sheep's-wool on the closed eyelid, and tie up with a handkerchief, exercising slight pressure on the eyeball so as to keep it quiet, and take the patient at once to the doctor.

To remove a foreign body, such as a pea or bead, from the Ear.—In the first place, if there is a doctor within twenty miles send for him; meanwhile, do not touch the pea, nor allow the child to push its fingers into its ear, even tying its hands down to prevent it so doing.

If on board ship, with no doctor, pass the narrow blade of a pocket-knife above the foreign body, taking care not to press upon it whilst so doing; rather wound the ear than touch the pea or bead. You should make up your mind to extract it at the first try, as each successive attempt further removes the possibility of getting it out. Instead of, and better than a knife, a wire with its extreme end slightly bent so as to make a tiny hook; if available, a Waverley pen, with its bent-back tip, will suit admirably. The hook is to be passed above the pea or bead with the point of the hook towards it; and when once passed over the foreign body it is simple enough to extract by tilting it out. Why you must be careful about this apparently little operation is that, if once the foreign body gets far in, inflammation of the brain may ensue.

To remove a foreign body from the Nostril.—Give a pinch of snuff or of pepper, so as to cause sneezing. Let the patient blow the nose violently; or, blocking up the side where the foreign body is not, let the air escape forcibly by fits and starts from the nostril containing the body.

WHEN A NEEDLE BREAKS OFF after penetrating the skin,

the patient must be taken at once to a doctor to have it extracted. If on board ship, with no surgeon, cut down with a razor or sharp knife on the needle, and remove it with sugar-tongs if you have no other forceps.

Suffocation, or asphyxia, comes about in various ways: choking on a piece of meat; inhalation of smoke, as in a burning house; inhalation of poisonous gas, as from a charcoal fire with insufficient ventilation, or escape of coal-gas; swallowing irritating fluids, such as caustics or boiling water; this is also the condition induced in drowning.

When from a piece of *meat* choking up the air passages, the patient, whilst laughing or busily talking when the mouth is full, starts up from the table, turns blue in the face, attempts to pass the fingers to the back of the throat, and then drops down insensible. The bystander should at once open the mouth, pass the forefinger down behind the tongue, and attempt to dislodge the particle of meat. No half-measures will do; this must be done at once, and decidedly. If the piece of meat is removed, but the patient does not come to, perform artificial respiration (see page 246). If the piece of meat does not completely obstruct the air passages, there will be probably violent spasmodic cough, with much difficulty in breathing, and the patient points to the throat. Here also open the mouta and remove anything you can see or feel with the finger. Thump the back hard, bending the body at the same time well forwards. If it is a child, and death likely to ensue, hold it up by the heels and thump the back hard.

If the suffocation comes from *smoke or gas*, get the patient into fresh air, and perform artificial respiration (page 246).

A common form of suffocation in children is brought about by their attempting to drink from the spout of a kettle which contains boiling water. The reason of their so drinking is that the kettle is used frequently by the poorer classes to make tea in, and the child, when it gets its mother's back turned, wants to get a drink of tea. It is not likely that any of the water is actually swallowed, but

enough is taken to cause choking, cough, and suffocation from the swelling at the back of the throat.

Treatment: Send at once for the doctor, and whilst he is being fetched, wrap the child in a blanket, apply hot sponges or hot flannels, dry or moist, to the throat, and set in an arm-chair before the fire. As in scalds elsewhere, oil—linseed, salad, or cod-liver oil—may be given.

POISONING.

The subject of poisons is so large that it is possible to tell you only the most meagre details as to symptoms. The treatment I shall make as general as possible, so that you will have a simple, sufficient and safe guide.

Some poisons induce sleep; others cause delirium; whilst a third class cause destruction of the tender lining of the mouth, throat, and stomach. This classification, although not technically correct, will be sufficient to guide you in your treatment until medical aid arrives.

I. Those which induce sleep, called *narcotics*, contain essentially opium in some form. Laudanum, morphia lozenges, many cough lozenges, and a few of the better-known children's elixirs, such as paregoric, Godfrey's cordial, and Mrs. Winslow's soothing syrup, are types of the class.

The treatment is, the administration of an emetic (see page 252), and attempts to keep the patient awake. This is done by walking the patient about, slapping with a wet towel, and the administration of strong black coffee. Slapping the soles of the bare feet with a slipper is calculated to keep the patient awake.

II. Those poisons which produce destruction of the lining of the mouth, throat, or stomach are the strong acids and alkalies and some metals.

The *acids* most commonly taken as poisons are: 1, oxalic (the salts of sugar, salts of sorrel); 2, carbolic; 3, sulphuric (oil of vitriol); 4, nitric (*aqua fortis*); 5, hydrochloric (spirit of salt).

The *alkalies* most commonly taken as poisons are caustic

potash and soda. These poisons are called, collectively, *corrosives.*

Treatment: Send for a doctor. Do not give an emetic, but administer: 1, linseed or salad oil; 2, demulcent drinks, as barley-water. In acid-poisoning, give alkalies, such as a tea-spoonful of magnesia or chalk, if it is to be had; if not, scrape the ceiling, or give common kitchen whiting. In poisoning by alkalies, give acids; the most handy one is vinegar, the acetic acid in it counteracting the action of the alkali.

The metals most commonly taken as poisons are: 1, arsenic; 2, mercury (corrosive sublimate); 3, antimony (butter of antimony, or tartar emetic); 4, lead (sugar of lead); 5, phosphorus. These poisons are called, collectively, *irritants.* The symptoms would be pain at the pit of the stomach, retching, alarm, and metallic taste in the mouth.

TREATMENT: SEND FOR THE DOCTOR. 1. GIVE AN EMETIC. To do this, adopt one or other of the following methods: *a*, tickle the throat with the finger or a feather; *b*, give a tablespoonful of mustard in a breakfast-cupful of warm water; *c*, a table-spoonful of salt may be used instead of mustard, but the mustard is the better. *d.* If these have no effect, send to the nearest chemist, if the doctor is not to be found, and tell him to send an emetic.

2. Administer a couple of raw eggs, beat up, and if they are not to be had, milk or some strong tea.

It is safe to give oils in all cases except phosphorus poisoning.

III. The third class are those which produce excitement; chief amongst these are prussic acid and strychnia. The excitement induced is immediate, and all that can be done is to try to prevent a fit coming on by slapping the face or dashing cold water sharply in the face. Administer an emetic if the condition admits of it.

IV. Alcohol is the chief type of the class of inebriants. It is the treatment of collapse from drink only that requires attention. Frequently do we meet with a poor wretch huddled in a heap in a doorway, who is the subject of this

condition. The patient will be found speechless, motionless, insensible, and with a bloated countenance. The odour of the breath, the pallor of the face, the weak pulse, the slow snoring respirations, and the dilated pupil, may, collectively, decidedly pronounce this to be what we are discussing; but mistakes are so frequently made between this and other serious conditions, notably apoplexy, that you must always give the patients the benefit of the doubt, and take them to a hospital or a doctor instead of sending them, on your own responsibility, to a police cell.

When you are sure of the condition of your charge, and no medical man at hand, induce vomiting and prevent collapse by applying heat without and within.

Simple directions for the treatment of poisoning. —*On all occasions send for a doctor at once.*

A. If you do *not* know what the poison is—

1. Get mustard, eggs, flour, milk, and tea.

2. Administer a tablespoonful of mustard in a teacupful of warm water as an emetic. [You may also send to the chemist for an emetic in case the mustard should fail. The chemist will know what to send, either 20 grains sulphate of zinc, or 1 oz. ipecacuanha wine, for one dose.]

3. Have the tea being made ready for use.

4. Break two or three eggs into a basin, beat them up, and administer at once; or give a handful of flour beat up into a cream, with water; a cupful of milk will do some good, if neither of these be handy.

5. Vomiting will now probably come on, if it does not do so within ten minutes, repeat the mustard emetic, or give the emetic the chemist has sent, if it has come.

6. When vomiting has ceased give the patient a cupful of strong hot tea and put him to bed.

B. If you do *not* know what the poison taken was, *but find stains on the lips*—

N.B.—Do not give an emetic.

1. Give at once a wine-glassful of olive (salad or sardine) oil, linseed oil, cod-liver oil, castor oil, or almond oil (*not oil of almonds*).

2. Put the patient to bed, apply smelling-salts to the nose, if need be, and hot sponges to the throat if there are signs of choking.

C. If you *do know* what the poison is, I would advise you to proceed with the use of the simple remedies, and do not attempt to remember antidotes. Did I tell you them, you would forget when you came in a hurry to search your memory, say five years hence; and whilst perplexing your brain over, it may be, a useless antidote, the object of your care may have slipped through your fingers for want of a cup of milk.

Remember the following broad facts: *When a person has swallowed a poison and threatens to go to sleep, keep him awake; when he seems going off into a fit, dash cold water in his face; when there are no stains about the mouth, give an emetic, eggs, milk, or oils (except in phosphorus), and end up with tea; when there are stains about the mouth, give oils, but no emetic.*

Sunstroke.—The following is from Dr. Dawson Turner's pamphlet (Longman, Green and Co., London):—

Sunstroke comes on suddenly whilst exposed to the direct rays of a hot sun, but heatstroke may come on at night. In the first place take all sensible precautions against these, by wearing a good thick felt hat with a wide brim, or a pith helmet, such as our soldiers now wear in India, with a good broad flap of linen hanging down behind so as to guard the nape of the neck. Cover the hat too with white calico, and do not, if you can help it, expose the nape of the neck to the rays of a tropical sun.

In case you are anywhere where you cannot get medical aid, act as follows: Strip the patient of his outer clothes; lay him down with his head and shoulders a little raised, and give him a cold douche, and plenty of it, by pouring jug after jug of cold water, from the height of three or four feet, on the top of his head and down his spine; or better, apply an ice-bag, if you can get it, to the head. Sponge also his hands, feet, and chest with cold water. Keep him in a darkened room, and where, if it is to be had,

there is a nice cool draught, and let him lie perfectly quiet and undisturbed. If he seems likely to sink altogether, put a blister or a mustard poultice on the nape of the neck.

Frost-bite.—Take great care not to bring the patient into a warm room or near a fire; or the most dreadful consequences may ensue, such as the loss of a limb, mortification, and so on. Rub the part affected, with snow in a cold room, and then bathe with ice-cold water, or lay bits of linen on the part soaked in ice-cold water; thus let the circulation be slowly restored. After a time give a little cold weak brandy and water.

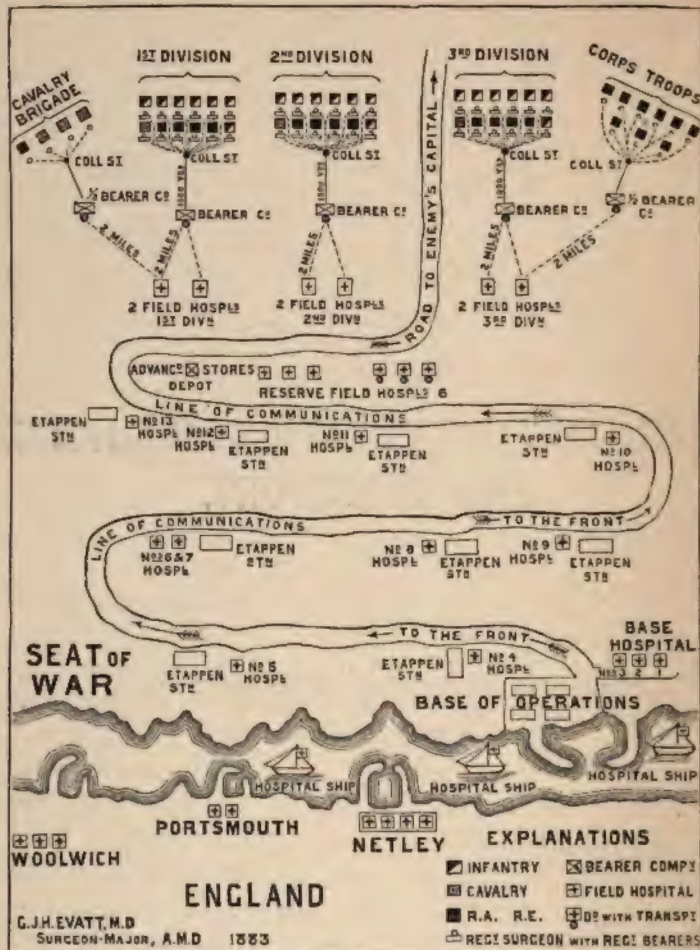
AMBULANCE ORGANIZATION, EQUIPMENT, AND TRANSPORT.

BY

SURGEON-MAJOR G. J. H. EVATT, M.D.,

ARMY MEDICAL DEPARTMENT.

PLAN OF THE AMBULANCE ARRANGEMENTS OF AN ENGLISH ARMY CORPS; STRENGTH, 36,000 men, 12,900 horses, 90 guns, 1153 waggons.



EXPLANATION OF DIAGRAM.

This Diagram shows each individual Battery, Battalion or Regiment in an English Army Corps, and also the number of units in each Division and Brigade. In the rear of each unit is the Regimental, Battalion, or Battery Surgeon, with his Regimental Ambulance detachment.

The dotted lines show the path of the wounded, *viâ* the "collecting stations," to the Bearer Companies of each division. Do not confound these with the Regimental Bearers working under the Regimental Surgeons.

Behind the Bearer Companies are the two Field Hospitals of each Division. Massed in their rear on the road leading to the Army are the six reserve Field Hospitals of the Army Corps, not as yet posted to Divisions.

The winding road is the Line of Communications, which may be 100 to 200 miles in length, and which extends from the Base of Operations to the Army in the Front. Along it are placed at the various Etappes, or Halting-stages of the Army, the thirteen Field Hospitals of the Line of Communications.

The winding road is so drawn to save paper.

At the Base of Operations are grouped three or more Field Hospitals constituting the Base Hospital.

The ships are the Hospital-ships which convey the sick and wounded from the Base Hospital to the English Hospitals at Netley, Portsmouth, Woolwich, &c.

PREFACE.

THIS primer or elementary handbook of Ambulance Organization, Equipment, and Transport, is written for the use of the casual visitor to the International Health Exhibition of 1884 who, entering the building quite ignorant of Ambulance aims and objects, desires to get a general, but elementary idea of the work.

There is nothing novel in these pages, and the specialist will not learn anything from them. They are simply cullings and extracts from the great writers' works on the subject.

I desire to offer my heartiest thanks to those who have aided me in this work. Foremost of all I thank Surgeon-General Longmore, C.B., the Professor of Military Surgery at Netley, for his extreme courtesy and kindness in allowing me the free use of the plates in his exhaustive special works on "The Transport of Sick and Wounded Troops," and on "Gunshot Injuries." Where the woodcuts were too large for the pages, I have had them copied by his permission.

Inspector-General Macdonald of the Royal Navy has also, in the most liberal manner, allowed me the use of his woodcuts and manuscript from his well-known work on "Naval Hygiene."

Sir John Watt Reid, K.C.B., the Medical Inspector-General of the Navy, has also been particularly kind in granting me the use of plans, &c., for which I beg to thank him.

Mr. John Furley, the well-known ambulance worker of England, has also been very good in giving me his valuable aid.

Baron Mundy of Vienna, the leading ambulance authority in Europe, has furnished me in the most liberal manner with copies of his detailed work on "Railway Ambulance Systems," of which I have fully availed myself.

Ober Stabs Arzt Starkè, of the Imperial German Army, has also been very kind in giving me information, and I have utilised several of his woodcuts from his elementary ambulance work.

Mr. John Collings, who has engraved several woodcuts for this primer, is also entitled to my thanks for his good work and his many useful suggestions.

G. J. H. EVATT, M.D., *Surgeon-Major*,
Army Medical Department.

ROYAL MILITARY ACADEMY, WOOLWICH,
May, 1884.

ENGLISH AMBULANCE SOLDIER.

CONTENTS.

CHAPTER IV.

CIVIL OR PEACE AMBULANCE ARRANGEMENTS.

CHAPTER V.

PERSONAL "FIRST-AID" EQUIPMENT.

CHAPTER VI.

AMBULANCE SICK-TRANSPORT APPLIANCES CARRIED BY MEN.

STRETCHERS, HAMMOCKS, DHOOLIES.

CHAPTER VII.

AMBULANCE SICK-TRANSPORT CONVEYANCES WHEELED BY MEN.

CHAPTER VIII.

AMBULANCE EQUIPMENTS CARRIED BY MULES OR HORSES.

CHAPTER IX.

CAMEL CARRIAGE.

CHAPTER X.

WHEELED AMBULANCE EQUIPMENT AND SICK-TRANSPORT VEHICLES DRAWN BY HORSES.

CHAPTER XI.

RAILWAY AMBULANCE AND SICK-TRANSPORT SYSTEMS.

CHAPTER XII.

MARINE AMBULANCE ARRANGEMENTS.

CHAPTER XIII.

AMBULANCE TENTS AND HUTS.

LIST OF ILLUSTRATIONS.

AMBULANCE ORGANIZATION, EQUIPMENT AND TRANSPORT.

CHAPTER I.

INTRODUCTORY.

I PROPOSE in the following pages to deal in a simple and entirely popular manner with the highly interesting subject of Ambulance Organization, Equipment and Transport.

I propose to treat the whole subject, whether as regards its application to the naval and military forces of the country for war purposes, or to the far larger needs of the civil population for the aid of those suffering from sickness or accident in ordinary every-day life, altogether from a popular standpoint, and to deal with the subjects in such a manner that the chance visitor to the Health Exhibition may be able to form some idea, however elementary, of what ambulance matters mean.

The specialist in such subjects will find in these pages little that is novel. The pamphlet is entirely a compilation, and very few lines indeed will be original.

In dealing in this primer with so large a subject it will be seen that only a very brief notice can be given of each separate group, but, as far as possible, reference will be made, pointing out where those interested in the subject can find fuller information.

By ambulance organization, equipment and transport, one means those various arrangements, whether for the military or civil needs of the people, by which first aid and

suitable transport is given to those suffering from sickness or accident up to the moment of their arrival at permanent hospitals, and a description of the systems, organizations, and equipment used for the purpose of giving this aid. The purely medical treatment side of this subject will not be dealt with in these pages, but rather the ways in which such treatment is placed in a position to do its work, and the various aids gained by definite organization in furthering such an object.

It may safely be said that ambulance aid and the good it can bestow upon humanity is still almost undeveloped. There is a growing spirit of humanity in the world, there is an intense desire to mitigate as far as possible the bitterness of human suffering, but it is the exact knowledge of how best to do it that the world needs. The want of light is really the obstacle, and hundreds of people are ready to do good if only they knew how to do it. To-day we are at the threshold of the true method, for we are teaching the people how to be truly humane, and when we have taught the individual this lesson, the municipality and the nation of which he is a citizen will gradually put into execution the wish of the people.

Is there one amongst us, who, either in war or peace, when help has been needed has not found the desire to give it in abundance, but it is the knowledge of how to give it that was absent.

Let us as the years go on teach the people, and all will be well. When we have taught the nation how their bodies are organized, of the laws that govern them, of the ailments that attack them, and of the injuries that mar them, then, and then only, will a real beginning be made to minimize by science the ills that befall humanity. The more this knowledge is spread through the land, the more importance will attach itself to ambulance matters of every kind, for it is a large factor in minimizing suffering.

The spread of the ambulance movement in civil life and amongst civil communities has arisen mainly from its development as a means of giving aid to the wounded in

war. The nations have been horror-stricken by the intense sufferings of a Crimean army, by the enormous mass of wounded after Solferino, after Gettysburg, after Sadowa, or at Worth; but all this suffering, great as it has been, has really been as nothing by comparison with that ever-constant, never-ending pain endured by the mass of civilians daily injured in railway accidents, in the streets, in the mines, and in all our varied industrial developments. When we think of these sufferers, as well as of the great numbers of sick persons travelling in unsuitable conveyances while suffering from dropsies, heart disease, rheumatism and other painful ailments, we must admit that, however great the pain that war has inflicted upon humanity, the longer eras of peace have contributed a far larger quota of grievous suffering. But the attention of the world has been riveted by the concentrated horrors of a great battle, and out of the efforts made to mitigate such sufferings, good in the end has come to the civil workman and to the whole of that industrial army daily at work throughout the country.

The plan I propose following in these pages will be to deal in order with the various groups into which the subject divides itself, leaving the plates to do much of the teaching and connecting them by a few lines of letterpress.

I will first of all describe in general terms the organized system by which ambulance help is given to armies in the field, explaining the official military methods of working such aid, and then referring to those various knightly orders and Red Cross auxiliary societies organized for supplementing this aid during war time.

Then I will endeavour to make a *précis* of municipal ambulance systems at work at home and abroad for the help of those suffering from injury or disease in civil life, and follow it up by indicating the various civil associations working with the object of urging forward this civil aid to the sick or injured.

I then propose to run rapidly through the detail of the various ambulance equipments, whether personal as carried by men, portable as carried by animals, wheeled convey-

ances for carrying the sick, railway ambulance arrangements, tents and huts used for temporary shelter, and winding up with a brief outline of nautical ambulance, or the methods used on board ship to carry or shelter the suffering. Owing to the limited space at my disposal I will in each of these sections take a type or special pattern, and, describing it, leave it to the reader to compare the type with the various evolutions from that type which he may find either in the Exhibition or in his various studies of the subject. I have here again to repeat that these pages are essentially a primer or elementary text-book, and must be received in that light.

CHAPTER II.

WAR AMBULANCE ARRANGEMENTS.

THE AMBULANCE ARRANGEMENTS OF AN ARMY IN THE FIELD.

[*Vide p.* 258]

Difference between ancient and modern war—The work of Larrey and Percy in improving Ambulance arrangements—The Medical arrangements of an English Army Corps—The Battalion Help—The Bearer Company—The Field Hospital—The Line of Communications—The Base Hospital—The Hospital Ships—The Medical Staff of the Army—The Militia Service—The Volunteer Service—Defects of an English War Hospital.

WHEN we look back over the history of the past in reference to the treatment of the wounded in war, we find that fighting in the old days was more logically carried out than at the present time.

When two armies met in ancient times the combat became a series of personal encounters, man opposing man and closing with his adversary in hand-to-hand fight. In those days few wounded existed, for after the battle, or during the fight itself, the stricken were slain outright.

To-day armies rarely close upon one another, large quantities of wounded from distant firing exist, and the spirit of humanity prevents the killing of wounded enemies. But in all our English foreign wars in India, China, New Zealand, Ashanti, Zululand, Egypt and Affghanistan, the old merciless principle is still in force with our enemies, and to be stricken in these wars and to fall into the enemies' hands is to be slain.

Another marked difference in the wars of the two past

centuries is that the old clan or tribal organization, as well as the feudal organization, has passed away in civilised countries.

There can be no doubt that the clan or tribal feeling supplied a tie between the chief and his men that rendered it impossible for a sick or wounded clansman to be abandoned to his fate.

In feudal times the baron, although he claimed the service of his retainer, had also in return to render service by protecting his "man," and no doubt a certain care had to be given to all followers of such a feudal chief.

With the breakdown of these old-world links, and with the foundation of standing armies, it is a question if the ultimate private man, that last unit who had in his clan or with his lord a definite link, has not lost on the whole. In becoming simply a unit in a great army, if that great army has not a good system of aid to the wounded, the individual private soldier loses most of all. To-day it would be absurd to say that our own, or indeed any foreign army, is yet completely organized in an ambulance sense, but much progress has been made in the past thirty years in achieving efficiency, and there is much promise of good results in the immediate future; the one thing needed is an educated public opinion.

Modern military ambulance arrangement dates its first step forward in a marked manner to the labours of Baron Larrey and Baron Percy, surgeons of the French Army during the wars of the French Revolution and the First Empire.

Larrey seems to have been the first to have devised a system of light ambulance transport carriages to convey the wounded rapidly from the battlefield to the field hospital, always some distance in the rear; and Percy has the credit of being the first to organize a regular corps of ambulance stretcher-bearers to carry the wounded from under fire, and from the actual fighting line itself to organized "dressing stations" immediately behind the very front ranks of the army.

Both these first steps in more perfect organization of ambulance aid have since then been carried to a far more definite development, and practically the clear lines of the German military medical system is now followed in all modern armies. This system may be summed up briefly as one freeing the front of the army from all sick and wounded, and evacuating all seriously sick to the great hospitals on the lines of communication, or at the base of operations.

The system can be more easily gripped by studying

Fig. 1.

REGIMENTAL AMBULANCE AID AT WORK—CAVALRY HELP TO WOUNDED.
(*After Ruhlemann.*)

the diagram of the ambulance arrangements of an English Army Corps which forms a frontispiece to this handbook.

An English Army Corps is the highest unit of military organization we have in the English military system, and any great army would consist of several Army Corps grouped together. If then we understand the arrangement of a single Army Corps, we can easily follow the larger arrangements.

The total strength of an English Army Corps is about 36,000 men, with ninety pieces of artillery. This body is commanded by a general, and is medically administered by a surgeon-general on his staff.

The Army Corps is divided for command into three

military divisions of all arms, one detached and separate cavalry brigade, and a body of reserve artillery and engineers called the corps troops.

Each division is again subdivided into twelve military units grouped in brigades and divisional battalions or batteries. The cavalry brigade has three regiments of cavalry and a battery of horse artillery, and the corps troops consist of five batteries of artillery (thirty guns) and four field units of engineers.

With each of these units, be it battalion, regiment or battery, on mobilisation for war, a medical officer is placed. He is the sanitary supervisor of the unit, and is a staff officer of the commander of the unit, and he remains with the unit throughout the campaign.

He has a certain amount of portable drugs and dressings supplied to him, and carried in "Field Companions," and he is supposed to treat any trivial cases of illness of a few days' duration; but no regimental hospital properly so called now exists in our own or any European army.

All seriously sick or wounded are now treated in divisional hospitals, of which more presently.

For ambulance aid this battalion medical officer has placed under his command two soldiers per company equipped with stretchers and surgical haversacs. These men have taken the place of the old scratch system of employing bandsmen, and they give aid to the regimental wounded under fire, and are called the regimental stretcher or ambulance detachment. They are in no way to be confounded with the "Divisional Bearer Companies."

When the regimental medical officer has given what rough help he can to the wounded under fire he sends them to the rear by his regimental bearers, and here a new organization, constituting an entirely new departure in our army, is met with: this is the Divisional Bearer Company. With each of the three divisions of an Army Corps is posted a Bearer Company completely non-regimental, and being really a divisional medical unit serving under the general and principal medical officer of the division. Half of such

a company is attached to the cavalry brigade and half to the corps troops. This makes a total of four such companies in an army corps.

Each company consists of eight surgeons and some two hundred and six Army Hospital Corps stretcher-bearers and transport drivers. These stretcher-bearers are trained in ambulance drill and first aid to the wounded, and in the

Fig. 2.

REGIMENTAL AMBULANCE AID—VARIOUS EXTEMPORISED AIDS TO WOUNDED.
(*After Starcke and Ruhlemann.*)

formation of dressing stations. Each company has two surgery waggons, water carts, and thirty-three ambulance transport waggons.

The surgery waggons are fitted up with boxes and baskets containing surgical dressings and instruments, cooking utensils, and medical comforts for the wounded. Each waggon has also an operating table and tent for surgical service at the dressing station.

These companies move directly in the rear of the fighting line, and having pitched the operating tent and dressing station, and left a suitable staff to assist there, they send forward the waggons to a "collecting station" further ahead, and just on the verge of the musketry fire. From this they again send forward the stretcher-bearers, who go on to the actual battlefield and collect and give a first dressing to the wounded, stop bleeding, give water and stimulants, and carry back the wounded to the collecting station and transfer them to the ambulance waggons. The

Fig. 3.

DETACHMENTS OF THE BEARER COMPANY AT WORK.
(*After Starcke and Ruhlemann.*)

regimental stretcher-bearers likewise co-operate, either loading their wounded directly into the ambulance waggons or handing them over to the bearer company staff on the field. The transport waggons then carry the wounded to the dressing station properly so called, where a completer examination is made of the wounded, where regular food is given, and where a classification of the cases can be made. From this place the wounded are sent back to the field hospitals of the division further in the rear, or if these hospitals are delayed in reaching the rear of the army, as

they often are, the bearer company dressing station becomes for the time a very advanced field hospital, where the wounded can receive a rough attendance pending the arrival of the hospitals upon the field.

We now come to the field hospitals. These units have replaced the forty-nine little hospitals which in olden days would have marched in the front line of an army in the field. Every English Army Corps has twenty-five field hospitals, each supposed to accommodate and nurse 200 sick and wounded. Of these twenty-five hospitals two are attached to each division, making a total of six, and six more are in reserve behind the fighting front of the army and ready to replace the divisional field hospitals when the latter become full of sick and are no longer in a position to advance with the force. Thirteen field hospitals are placed along the communication line at the various *étappes* or halting stations of the army, and at the base of operations three or more of these are grouped to form a base hospital, one of the most essential institutions with an army in war time.

A soldier if hit in the front of the army is roughly dressed by the battalion doctor, he is then taken to the divisional dressing station and completely examined and fed, thence he passes to the divisional field hospital, where if he be trivially hurt he remains, recovers, and rejoins his battalion, but if seriously sick or injured is sent back by the lines of communication towards or to the base hospital. Here if he recovers he again is sent forward and rejoins his corps, but if completely injured and broken down, he is placed in the hospital ships, and in due course arrives at Netley and England.

The medical service of the army consists of three bodies, viz., the Army Medical Staff, composed of physicians and surgeons commissioned in the army. These officers are responsible for the working of the medical and sanitary service of the army, command the medical corps, and are governed by a Director General who belongs to the War Office Staff. There is also a Medical Corps of some 2200 hospital attendants trained to nursing and ambulance

duties. This corps has a training school at Aldershot, where the rank and file are instructed in all ambulance and medical duties. Finally, there is the Female Nursing Service, a limited body of ladies serving in some of the larger military hospitals. The Nursing Service has a Superintendent who is its responsible head under the Director General of the Medical Service. She is stationed at the Royal Victoria Hospital, Netley, Hants.

Turning from the regular army to the auxiliary services, we find our large Militia force completely defective in ambulance and medical arrangements, and it is now proposed that a body of militia, some 1200 men, should be trained annually in ambulance drill so as to form a supplementary help for the army in time of war, and this will be highly advantageous to the country.

Our large volunteer army 200,000 strong, is completely unprovided with bearer companies or field hospitals, and has nothing but some regimental help. There are probably not half a dozen ambulance waggons with the whole volunteer force. Public opinion is now being awakened on this head, and it is hoped that a battalion of medical volunteers will be raised in London, Yorkshire, and Lancashire, and that companies capable of forming field hospitals and bearer companies, will be formed in each English and Scottish county, and in many large towns.

It is a great pity the volunteer army is not made completely efficient from an ambulance point of view.

The ambulance service of the military force of this country must be looked upon as completely in a stage of development. The *matériel*, or the waggons and equipment of the bearer companies and the field hospitals, are singularly heavy, cumbrous and unsuited to our varying wars. No complete standard equipment of a field hospital to be carried on mules exists either in this country or in India. Concerning ambulance railway carriage and its development there is still much to learn. It will be useful to note any foreign equipment sent to this Exhibition, and to copy its good points. Field cooking as

now generally provided for in the armies by special portable cooking waggons is also a subject needing much development.

So far as concerns the ambulance *personnel*, an English war hospital for 200 sick is completely undermanned, and it is impossible to make it work efficiently with the small number (thirty-seven) of men supplied to it.

No provision whatever is made for water carriers, washermen or sanitary police, and as a consequence great difficulties arise in war time. It is entirely to the advantage of the country and its soldiers that public opinion should understand what ambulance aid means, so that real field efficiency may ever follow our military ambulance arrangements. The more the ambulance arrangements of the army, the militia, the volunteers, and the red cross societies are developed in England the better will it be for that private soldier on whom in all our wars the heaviest sufferings from ambulance shortcomings fall. All who desire to study further English war medical arrangements should purchase the 'Army Medical Regulations,' to be obtained from any military booksellers, such as Messrs. Clowes.

CHAPTER III.

VOLUNTEER WAR AID.

THE KNIGHTLY ORDERS AND THE RED CROSS SOCIETIES.

The Knightly Orders and their work—The United States Sanitary Commission—The foundation of the Red Cross Movement—The Geneva Convention—The good and the weak points of the movement—Little help given to the English Army by Red Cross Societies—The work that might be done by the English Red Cross Society—The Johannritter Order of Germany—The "Deutsche Ritter" Order—The Austrian Maltese Order—The Italian Branch of the Knights of St. John—The English Order of the Knights of St. John—The Addresses of the Head Quarters of the European Red Cross Societies—The Periodical Press of the Red Cross—Gustave Moynier's "Red Cross and its Future."

THE different conditions of an army in peace and in war, as regards the needs of ambulance aid, are so marked that it can easily be seen how great must be the reserve help capable of being called out in war time over ordinary peace needs.

War is an epidemic of injuries and special diseases occurring amongst men who in peace time are little exposed to either conditions.

To maintain permanently the establishments suitable for medical war needs in peace would be impossible, and a reserve system capable of being called out for a campaign is the real need of all ambulance services.

Private humanity has never failed in all our wars to endeavour to mitigate the sufferings of the sick and wounded.

We may presume that it has always been so in the world in greater or less degree.

The spirit that in the crusading time founded the great hospitaller knights orders, was doubtless the humane effort of noble hearts who bled to think of the sufferings of the pilgrims and crusaders on their trying expeditions to the Holy Land. These orders were truly the forerunners of the great red cross movement of our own times.

They commenced, doubtless, in small beginnings, and were poor and weak at one time, but gradually they gained strength and power, and with it came a fading away of that great spirit of self-sacrifice which first gave them birth. Their rich estates and noble commanderies once spread over Europe, but to-day it is only in Austria that the endowment of the orders survives to any extent.

With the decay of the crusading spirit their hospitaller duties passed away, and they really became military knightly orders.

Reformations and revolutions swept away their property in many countries, and what survived of the knights seem to have become intensely narrow, and absurdly aristocratic, and exclusive in their organization, and forgot altogether the object which first brought them into existence. The red cross movement of our own day has been like some great democratic wave which has stricken down the barriers, and both the orders themselves and the world in general have been benefited by the flood of enthusiasm it developed. Private humanity did much for our army in the Crimean campaign in supplying money for the purchase of comforts for the suffering, and it would have done still more had it but known how to do it.

Probably the greatest outcome of national sympathy with suffering ever seen in this world was the work of the United States Sanitary Commission during the war of the rebellion in America, 1861–65. Its stupendous efforts and magnificent results will remain through all the ages as a landmark of humanity acting in its best form to relieve suffering. The story of its work in aiding the regular medical service of the United States army, the new departures it made in hospital comfort and organization,

the many-sided developments it has produced in reducing war suffering, will never be forgotten.

Immediately before the American war, another campaign had occurred in which much misery had been endured by the wounded. This was the Italian campaign of 1859. But out of its great horrors, and out of the depths of its sufferings, came refuge at last, and a better future dawned upon the world.

If one is asked to propose a saint for canonisation and to name in his honour a new order, let the saint be St. Henri Dunant, and let the order be called the Dunantines.

It is to Henri Dunant the world owes the origin of the red cross movement.

Horror-stricken by what he saw, he published a book called 'Un Souvenir de Solferino,' detailing the sufferings of the wounded in the Italian campaign of 1859, and as a result of his work a committee was held to discuss the subject of the treatment of the wounded in war, at Geneva, on the 9th of February, 1863, which led up to an International Conference at the same place in October 1863. The 9th of February, 1863, may be looked upon as the date of origin of this never-to-be-forgotten movement, which has for its aim the mitigation of suffering in war, and the provision of suitable aid for the sick and wounded in the field. The International Conference drew up a series of resolutions and recommendations, bearing upon the need of volunteer assistance to supplement the official help given to the wounded in war. It also recommended the neutralisation of the medical corps and all its attachés, civil, volunteer or military. It also founded a distinctive badge, the "red cross," on a white ground, and recommended it to be borne by all the medical corps, *personnel* and *matériel* of every class and kind.

This International Conference led the way to the drawing up of the "Geneva Convention," signed on the 22nd of October, 1864, by the accredited representatives of the leading European nations.

By it the contracting nations agreed to the neutralisation of the medical corps, and the hospitals and their attachés, and also of civil inhabitants aiding or sheltering the wounded. It recognised the Convention flag, but it in no way specially recognised red cross societies as such. In 1868 and in 1874 some further suggestions were put forward as additions to these principles, but they have not been ratified.

The Red Cross Societies exist now in every European and many other extra European countries; they have, however, no official *international* recognition. The distribution of their badges is still *officially* subject in each country to military supervision. There are still *National* Societies subordinated to the military authorities of their own country. They have of course their centre for administrative and consultative purposes at Geneva, but this Central Committee has no official recognition. These National Societies have done an enormous good to humanity, directly and indirectly. They have, by their direct action, supplied for the sick and wounded an immense amount of assistance, both in *personnel* and *matériel*, and have been the great channel for national charity, and they have indirectly stimulated to a very great degree the slower moving state-controlled action of the official military, and medical authorities. In many countries their *personnel* is more numerous, and their *matériel* more complete, than that of the official medical services, and being freer to move, and being more influenced by public opinion, they have pushed forward ambulance assistance in a very marked degree. The stimulus they have given to the official medical services has been almost all for the best, although, as in many movements, there are weak points to be indicated.

The general outline of the organization is as follows:— At Geneva there is an International Committee keeping up communication with all the National Societies, and publishing a paper quarterly as a circulating agent between the different countries.

In each country there is but a single Red Cross Committee representing the whole national organization. In some

countries there is distinct official connection between the societies and the military authorities, in others this is not the case. Money is collected, ambulance *personnel* and *matériel* collected and trained, and the agents of the Red Cross during each campaign hasten to the scene of action, and endeavour to give what aid they can by money, men, or advice.

Of course in a movement of this kind adverse criticism is also heard.

The distribution of the Red Cross has in many instances been carelessly done; unfit men and unfit women have at times received it, and a crowd of mere idlers have used it for a screen for their idleness. Swarms of *blasé* men have, under the protection of the Cross, to which they had no claim whatever, haunted the battle-fields, and under the guise of giving ambulance aid, have merely gratified a morbid curiosity. Numbers of "wild women," without discipline, without organization, owing allegiance to no chief, have flocked to the armies in the field, to encumber and obstruct the real workers, and to degrade by their extraordinary freaks the noble intentions of the founders of the League of the Red Cross. But, after all, these weaknesses in the movement have been few, and the good achieved has quite overbalanced them. What we need for our assistance in war is trained and disciplined help, come from what source it may. Scratch-teams of sensation-loving men and women we do not need in war. We need to have drilled and disciplined Red Cross volunteers, chosen calmly in peace, medically examined as to physique, morally examined as to character, enrolled with regularity and commissioned in due form, called out at intervals for inspection, and liable to expulsion for breaches of discipline.

Instead of a mere arm-badge, these societies need a complete uniform, not to be worn save by authority, and their documents and their defaulter sheets should be ready to be produced. Then, indeed, such societies of nurses, attendants or officers, would be of value; but we must have discipline, exact, distinct, and unquestioned.

For us, in the English army, Red Cross aid has as yet

done little; our hard campaigns in Ashanti jungles, in New Zealand fern thickets, in the cholera-haunted defiles of Affghanistan hills, or on the burning shores of the Soudan, have not attracted the followers of the Red Cross Societies.

We are the one army in Europe which has to trust almost entirely to our official medical service, and hence the need of its being strong and efficient; hence the need of it having its own trained disciplined and entirely available official reserves. But we still should hold out a ready hand to all well-organized Red Cross aid, provided only it be disciplined, and that we can see it, and inspect it, and test it in peace for war.

What the mission of the English Red Cross Society (National aid to sick and wounded in War) should be, is to stimulate popular feeling by publishing pamphlets, giving prizes for essays on subjects connected with war-hospital work, by purchasing and exhibiting new patterns of ambulance *matériel;* by enrolling, drilling, clothing and disciplining volunteer ambulance companies; by granting money to purchase extra comforts for the sick in war; by continuing its good work of organizing female nursing services on disciplined basis capable of assisting us in our war work; by forming in London an Institute, where war medical equipment could be exhibited, lectures given, and discussions held on war-aid questions, and perhaps by founding a medal of honour for those who did good service in its cause. The Society should be a living force, influencing for good all popular opinion, and aiding us in the official medical service by teaching us and the world what our true needs are. The need of an English Red Cross Journal is very great indeed. The Red Cross movement may then be summed up as the outcome of a desire on the part of the peoples to mitigate in every way the suffering of the sick and wounded in war time. It is an uprising of human sympathy against the coldness and want of energy of official organizations. In every country in Europe, and in many foreign states, it has collected money, men and material—all for service in this good work.

The initiative of Henri Dunant has been taken up far and wide through the world, and the seed he has sown is bearing everywhere good fruit. These societies, beginning in voluntary effort, will gradually become more and more completely identified with the national forces of each country, and eventually, as a result of their labour, the official medical service will become more and more efficient. Such reformations and such developments are bound to occur from time to time in the world, and we should gladly accept the good work done by them. The Red Cross movement will in future ages mark most distinctly the period in which we live.

The following are the names of some of the Knightly Orders aiding the wounded, and the addresses of the various Red Cross European Societies.

A. *The Johannritter Order of Germany.*—The German section of the Knights of the Order of St. John of Jerusalem, a highly aristocratic Evangelistic Protestant organization, occupies a very prominent position amongst German aid-organizations. The Order of St. John had existed in Germany as a Brandenburg branch for many centuries, and was remodelled in 1812, as a Royal Order, but apparently the revival of its war-aid work is of quite recent date. To-day it holds in Germany proper the chief position as the central organizing body, through which the German Imperial authorities deal with the various aid societies of the different countries in the German Empire.

B. *The Maltese Knightly Order of Germany.*—This Order is the Roman Catholic division of the same Order. It apparently works on the same lines as the Johannritter Order.

C. *The Austrian Order called "The Deutsche Ritter," or Teutonic Order (Catholic).*—This Order has long been in the field at aid work, and occupied the ground in Austria from mediæval times, and long before the Red Cross movement. It has a distinct agreement with the State as to its duties, and its ambulance-waggons and its *matériel*, which are found in each division of the army, seem very complete. It divides its war work in a definite manner

with the Austrian Red Cross Society. It apparently has no *personnel*, only *matériel*.

D. *The "Souveranen Malteser Ritter Ordens Gross-priorat von Böhmen*," or *Austrian Langue of the Sovereign Order of the Knights of St. John*, seems to be a powerful and wealthy military Order, furnishing complete trains of railway ambulance, transport, and field *matériel* to the Austrian army. It provides surgeons, attendants, and the knights themselves also take the field. Its railway ambulance trains, organized by Dr. Baron Mundy, are the most complete in Europe. The Order seems to possess large estates in different parts of the Austrian Empire, having probably escaped the confiscations which reformations or revolutions have brought about in other countries.

E. In Italy the Knights of St. John seem to be useful and active, and in Spain particularly so, working there in direct unison with the Red Cross Society of Spain.

In England the Order of St. John of Jerusalem is not very active in war work, and is more known by its modern civil offshoot, the St. John's Ambulance Association, of which more by-and-bye.

The English Order of St. John (Protestant) has its headquarters at St. John's Gate, Clerkenwell, London, E.C. There is also a Catholic branch of the Order of St. John in England, but it does no war service.

F. The principal Red Cross Societies are as follows :—

International Committee at Geneva.—Rue de l'Athénée No. 3, Genève (Suisse). President, Gustave Moynier.

Central German Committee.—Wilhelmstrasse 73, Berlin.

Austria and Hungary.—Austrian Red Cross Society. Herrengasse 7, Vienna. Hungarian Society. Kettenbrückengasse 1, Buda-Pest.

Baden.—Comité Général de la Société Badoise de Secours. Herrenstrasse 45, Carlsruhe.

Bavaria.—Comité Central de la Société Bavaroise pour les soins et l'assistance à fournir aux militaires blessés. Munich.

Belgium. — Comité Central Belge. Rue Royale 42, Brussels.

Denmark.—Buloswei 24, Copenhagen.

Spain.—Association espagnole de la Croix Rouge. Plazuela del Humilladero 6, Madrid.

France.—Société française de Secours aux militaires blessés. Rue Matignon, 19, Paris.

England.—National Aid Society to Sick and Wounded in War. 5, York Buildings, Adelphi, London.

United States, America.—American Red Cross Society, Washington.

Greece.—Société grecque de Secours aux blessés. Athènes.

Italy.—Central Italian Committee of the Red Cross. Palazzo Lantè, Piazza Capellari 70, Rome.

Holland.—Comité Centrale de la Société Néerlandaise de la Croix Rouge. The Hague.

Prussia.—As for Germany.

Russia.—Comité Central russe de la Croix Rouge. Rue des Ingénieurs 9, St. Pétersbourg.

Saxony.—Comité Central des Secours aux militaires blessés. Dresden.

Switzerland.—Société Central suisse de la Croix Rouge. Zurich.

Periodical Press of the Red Cross :—

1. "Kriegerheil," organ of the German Societies; monthly at Berlin.
2. "Messenger of the Russian Society." Weekly at St. Petersburg.
3. "Caridad en la Guerra." Madrid; monthly.
4. "Military Medical Journal." Stockholm.
5. "Philanthrop." Organ of the Swiss Society; Zurich.
6. "Bulletin International des Sociétés de la Croix Rouge." Organ of the International Committee, and published at Geneva; quarterly.

Those who desire to learn more about the Red Cross Societies should read Gustave Moynier's "Red Cross and its Future," of which Mr. John Furley has made a translation, which is published by Cassell, Petter, Galpin & Co. London.

CHAPTER IV.

CIVIL OR PEACE AMBULANCE ARRANGEMENTS.

The Ambulance arrangements in American Cities—Need of the same in England—The treatment of Drunken men in the streets—Street Stretcher-lockers — A London Ambulance Service — Railway Ambulance arrangements—Poor Law arrangements—Example of a Municipal Ambulance System—The Metropolitan Asylums Board and its work—The Hospitals and Ambulance arrangements —The old Parochial System and its defects—The Ambulance Steamer "Red Cross" on the River Thames—Rural Ambulance Systems—The Battle District of Sussex—Lady Brassey's System—The Town of Brighouse in Yorkshire—Civil Ambulance Societies—The St. John's Ambulance Association and its work—The good done by it—The London Ambulance Service—The St. Andrew's Ambulance Association—The Samaritan Society of Kiel.

WE have in a previous page of this Manual pointed out that it was mainly owing to the developments of war-ambulance systems that civil arrangements have sprung up.

The striking effects of a great battle, and its consequent miseries to the wounded, have ever arrested public attention in a manner that the more scattered accidents and sufferings of civil life have failed to do.

Yet when we remember our long-continued industrial warfare, with its daily casualties, and the vast sickness of our civil population, it will be understood how far greater are our civil ambulance needs.

On this point, as on many others, the people want light. Until the average citizen knows what a compound fracture is; how arteries bleed, and why; and understand some of the risks and pains attending the movement of cardiac or dropsical patients, great developments will not come. It is to the great cities of the New World, like New York,

Boston or Chicago, we have to turn to learn lessons as to civil ambulance arrangements.

We find in these cities regular ambulance conveyances, and a special staff of surgeons, attendants, drivers and horses, attached to the great municipal hospitals. The great central thoroughfares, the police stations, and the hospitals, are all united by telegraphic or telephonic communications.

At once on the occurrence of a street accident, a telephonic message is despatched to the District Hospital for aid, and, as a rule, in three minutes after the message is received, a specially constructed ambulance carriage, containing a medical official, with appliances and restoratives, is speeding on its way to render aid to the sufferer. The New York system is singularly perfect, and Boston and Chicago are not far behind. When we remember the vast numbers of persons run over and injured by carriage accidents, fall from scaffoldings, or stricken down by the many risks of our great factories, we all must admit that England generally, and our great cities in particular, need such organization of help almost more than America.

To stimulate all this humane work, what is needed is light. Every one rushes to aid in an accident; but, alas! the people do not know how to give aid, they know not what to do, or what not to do; and so it is that injuries, in themselves light, are gravely complicated by ignorant handling. How needful then is it that we teach the people, and that we by so doing sow the seed for the development of ambulance-organizations!

The removal also of people suffering from heart-disease, rheumatic affections, infectious disease, dropsies, is also a subject of great importance, and it would be possible to tell many painful stories of the suffering caused by the absence of suitable stretchers and carriages for use in such cases.

Take, again, the question of drunkenness in our streets. Can anything be more degrading to human nature than to see a body of policemen struggling with a man in the mad stage of drink-poisoning? The struggles of a drunken man in his excitement are as surely the symptoms of poisoning, as

the muscular cramps of strychnine poison mark the action of that deadly drug. The treatment in one case should be as carefully guarded as in the other; yet have we not seen the murderous and cruel "frog's march" practised on drunken men, where the poisoned sufferer is carried with his head within a few inches of the ground, and all the blood of his body gravitating towards it. How many cases of police-cell apoplexy have really been murders, from ignorance from want of organization and education on this head?

The day will most surely come when such sights will be no more seen. The stretchers so needed for these cases will not be found in police offices only; but in every street of our cities red-painted lockers, like enlarged post-boxes, will contain a stretcher ready for use. Every policeman or local householder will have a key.

Every post-office will have such a stretcher, every railway station in the country; and shall we say every public house also, so that they who sell the poison may also keep on hand a physical relief for its effects?

A drunken man shall then be at once overpowered and strapped on the stretcher, and so borne to the hospital or police ward told off for such cases.

Nay more, we shall one day have municipal ambulance (sick transport) waggons attached to our great hospitals, or to special ambulance stations, and these waggons shall receive both accident cases or drunkenness cases on the stretcher as they are, and so place them in the waggon and drive them rapidly to the relief centre. It is only in this way we can free our streets from painful and degrading sights, and at the same time provide for accident cases.

London and every city should be mapped out in districts, and these districts allotted for ambulance-purposes to the local hospitals and the local police centres.

Telephonic communication should run from the streets to the hospitals and the police depôts, and at the hospitals the waggons or carriages should stand ready for constant use to drive to the scene of the accident. Trained medical

officials should be on duty, ready to leave with each carriage and to assist the injured person. The stretcher in the carriage should be interchangeable with the one in the street-stretcher-locker, and should replace it at once, receiving in return the sufferer and the other stretcher.

For the carriage of the sick, and those enfeebled and handicapped by disease, a special arrangement is needed, which only a strong municipal government will ever be able to organize.

The London Hospitals should come under a central Board, and their funds be "pooled" in a common fund, having in reserve the municipal rates to fall back upon.

The existing hospitals, and the many other municipal hospitals needed, should be distributed with system over our great city. A chain of outposts in the shape of municipal dispensaries should bring medical relief within a quarter of a mile of every citizen. Here first aid should be ever ready, and here the outpatients now swarming and crowding at our great hospitals should be dealt with in detail and by districts. At certain hours in the morning, midday, and evening, the sick-transport waggons from the great central hospitals should call at these outlying dispensaries, and carry in comfort the cases chosen for admission to the district central hospital. But far more than this is needed, for a ring of great hospitals, combining in the same extensive grounds both convalescent and treating sections, should surround London at a distance far removed from the smoke and overcrowding of our great city. Alike on the Sussex coast, on the Surrey hills, or mid the heaths of Berkshire, should be found those great outlying, overflow convalescent and treating municipal hospitals, to which, according to the nature of the case, each patient could be forwarded, but how? By special ambulance railway trains, leaving every morning with sick and returning every afternoon with the recovered. These trains, well fitted for every ailing case, will one day be as common as the sleeping-cars of the Pullman trains are becoming common, and an inestimable boon they will be to all using them.

And this leads me to the subject of railway-ambulance arrangements, now so completely defective. First, (*a*) every railway porter should be taught the elements of ambulance aid, in lifting injured persons. It is easily learnt.

(*b*) Every railway station needs a carrying chair, for carrying invalid travellers from their conveyances to the carriages.

(*c*) A stretcher should be kept by order in every railway station throughout the length and breadth of the land, ready for use.

(*d*) In the guard's-van of every train of every class, such a stretcher should be kept folded up and put away, but ready for use, and iron clamp stanchions, after the "Hamburgh system" (to be described afterwards), kept ready also for suspending the stretchers.

(*e*) To all breakdown trains should be added proper ambulance carriages, fitted up for the conveyance of those maimed in our railway accidents, and similar carriages should be available for passengers, if needed, at fair rates. Charitable societies might well supply the carriages and keep them in order. This would be really practical humanity.

In country districts the Poor Law unions furnish a ready machinery for ambulance aid. At every central union hospital, ambulance carriages, both for sickness and for infectious disease, should be kept; and in all the outlying parishes, stretchers and smaller-wheeled ambulances. Telephone communication would connect the outlying districts with the central hospital. Examples will be given further on of all these systems.

In mining districts and in all our great factories, stretchers should be kept by the owner, and either hand-wheeled ambulances or horsed-carriages be available for aid. The absolute saving of money to the world by preventing a simple fracture becoming compound, would well pay for all appliances a hundred times over.

On our rivers and harbours, ambulance launches and steamers, specially constructed for the injured or the sick,

should be placed by the Local Board responsible for the sanitary police of the river.

We will now describe with more detail some of the existing systems of civil ambulance arrangements.

MUNICIPAL AMBULANCE SYSTEMS.

Arrangements of the Metropolitan Asylums Board, London.

Vide Plan, Fig. 4.

The Metropolitan Asylums Board of London has now at work in the Metropolis a system of ambulance arrangements well worth studying.

This Board, amongst other important duties, is responsible for the medical care and hospital accommodation of all cases of infectious disease occurring amongst the pauper class in greater London.

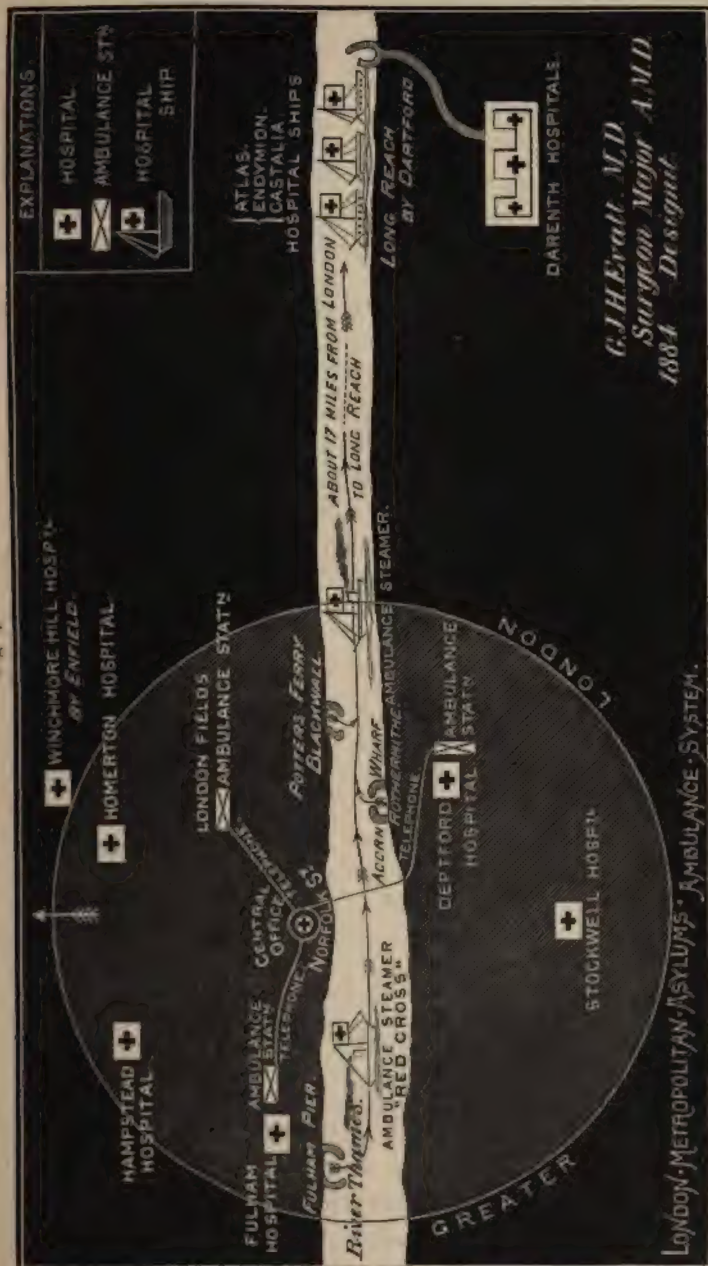
Its schemes of work are yet in the stage of development, and not completely worked out, but they may be explained in general terms, and the lines of work broadly indicated.

Previous to the formation of this Board, the various parishes dealt or did not deal with their own infectious cases. The Metropolitan Asylums Board have now in greater London five infectious disease hospitals. (Vide plan, Fig. 4), viz.: Hampstead, Homerton, Fulham, Deptford, and Stockwell. In these central hospitals the pauper sick of the districts are received up to a certain number, and with special reference to the class of cases. Practically these central hospitals are for grave acute cases, which cannot stand the fatigue or risk of removal to the outlying hospitals, of which we shall speak directly.

A limited number, probably not more than fifty serious cases of small-pox, would be kept in these central district hospitals, and of fever cases a somewhat larger number, but no excessive number will ever remain in them.

Outside London proper, in the country districts and amidst healthy open surroundings, great overflow hospitals for the reception of mild, or convalescing, or convalescent cases, are or will be formed for fever at Winchmore Hill,

Fig 4.


EXPLANATIONS.
HOSPITAL.
AMBULANCE STN
HOSPITAL SHIP
WINCHMORE HILL HOSPL BY ENFIELD.
HOMERTON HOSPITAL.
HAMPSTEAD HOSPITAL.
LONDON FIELDS AMBULANCE STATN
FULHAM HOSPITAL
AMBULANCE STATN
TELEPHONE
CENTRAL OFFICE
NORFOLK ST
POTTERS FERRY BLACKWALL
FULHAM PIER.
River Thames.
AMBULANCE STEAMER "RED CROSS"
ACORN
WHARF
ROTHERHITHE AMBULANCE STEAMER.
TELEPHONE
DEPTFORD HOSPITAL
AMBULANCE STATN
STOCKWELL HOSPL
ABOUT 17 MILES FROM LONDON TO LONG REACH
ATLAS. ENDYMION. CASTALIA. HOSPITAL SHIPS
LONG REACH BY DARTFORD
DARENTH HOSPITALS
G.J.H. Evatt. M.D. Surgeon Major A.M.D. 1884 Design.
GREATER LONDON
LONDON · METROPOLITAN · ASYLUMS · AMBULANCE · SYSTEM.

by Enfield; and for small-pox, in the three hospital ships, *Atlas*, *Endymion*, and *Castalia*, moored at Long Reach in the Thames River by Dartford and Purfleet, with a further reserve hospital on the shore at Darenth close by the hospital-ships' moorings.

This shore hospital at Darenth will be a great overflow hospital, available for first admission in case of an epidemic, and also as a convalescent hospital for ordinary cases in ordinary times.

To convey patients to these central and outlying hospitals the system is as follows:—

When a case of infectious disease occurs in a locality, the medical officer reports to the district relieving officer. This official telegraphs to the Central Asylums Board office, Norfolk Street, Strand. This office is connected by telephone with the ambulance stations existing and under construction at Deptford, London Fields, and Fulham.

These ambulance stations are admirably organized, and, so far as we have seen them, well worthy of study as patterns of ambulance stations.

A staff of superintendents, drivers, and subordinates are on duty in each station. Suitable (sick-transport) ambulance waggons for conveying infectious disease stand ever ready to be horsed. The horses are in stables close by, ready for hooking in. The whole disciplinary, sanitary, disinfecting, and precautionary organization of the station leaves nothing to be desired, and seem to us to be in every way a model worth copying. When one reads the ghastly record of the style of conveyances used only five or six years ago in London, to convey those unfortunate sufferers stricken with contagious disease to the proper hospitals, one rejoices beyond measure that so successful an effort has been made to render human misery less. Let us fancy the pauper sick of the Plumstead, Woolwich, and Charlton districts, who, up to 1877, when stricken with small-pox had to drive sometimes fifteen miles, sitting on a board, in a conveyance in which they could not lie down. These conveyances used for small-pox were never disinfected,

and stood in sheds with other carriages. Of Shoreditch we read, "In the small-pox cab the patient cannot lie down or even stretch his limbs;" of Marylebone, "The patient cannot lie down;" of Hampstead, "The patient must lie on the floor of the vehicle;" of Clerkenwell and Holborn, "The patient cannot lie down," "never disinfected." St. Pancras, "Patient cannot lie down." What comfort to know this wretched misery is now past and gone!

At these perfect ambulance stations, which we now possess, night and day, on the receipt of a telephone message from the central office, in three minutes a carriage starts for the infected house. As it leaves the gate, a nurse with a basket of restoratives in her hand steps in, and proceeds to the house to superintend the removal.

From the house the patients are taken, if grave cases, at once to the district hospitals. If they be of milder type, small-pox cases are carried to the river ambulance stations, which are or will be formed at Blackwall, Fulham, and Deptford.

At wharves at these stations the special ambulance steamers—one of which, *The Red Cross*, is now at work, and another is under construction—will convey the cases down the river to the hospital ships at Long Reach.

In detail, further on, we will describe the various *matériel* used in this work, but the general outline is as we have described. It will be seen at once that an identical system suitable for non-infectious ordinary disease can one day be developed in London. The existing hospitals will become receiving houses for grave cases and sudden illnesses; and round London, overflow hospitals, combining treatment and convalescence, will be founded. Ambulance sick-transport waggons will collect the sick from the districts for the London central hospitals, and regularly organized ambulance trains will convey the invalids who are relegated to the country outlying hospitals to their destination.

All that is needed to start this important work is a central municipal authority.

Rural Ambulance Systems.

It will be easily understood that for country districts an ambulance system can easily be adopted to the present union organization.

Every centre of a union should have a sick-transport carriage for infectious disease, and another for non-infectious disease.

The various outlying parishes should be united to the central office of the union by telephone, and the carriages could then be despatched as needed to the various places.

Fig. 5.

AMBULANCE ORGANIZATION ROUND THE BATTLE DISTRICT OF SUSSEX.

For accidents and non-infectious cases, stretchers with wheeled appliances should be kept in each village, local police office, local post-office or other place, the stretcher fitting into the central sick-transport waggon, and being exchanged with the patient on it for the stretcher in the waggon, which would be returned to the place from whence the stretcher was taken.

The diagram shows the system on which Lady Brassey, a regular ambulance missionary, has organized the Battle district. The secretary dwells in the Battle centre, and the outlying parishes are organized in connection with it,

and supplied with ambulance *matériel*. Any day our Poor Law unions could be so organized, but to achieve it we should teach every guardian what a compound fracture means. Until this is understood, progress cannot come.

Town and Village Ambulance Arrangements.

As an example of good work done in towns and villages, we would mention the ambulance organization of Brighouse in Yorkshire. Here a branch of the St. John's Ambulance Association was formed, and, under an active secretary, the local police, firemen, and many inhabitants, have been trained in first aid to injuries. An ambulance institution has been founded, and we find the following *matériel* available on the spot. One-horse ambulance (sick-transport) carriage for four patients, four two-wheeled Ashford litters, seven stretchers, one police-stretcher for drunken cases, one hamper of appliances for dressing, books, bandages, and diagrams, and a wooden coach house for the ambulance (sick-transport) carriage. Is not this highly creditable? and why should it be an exceptional case?

Civil Ambulance Societies.

It is to the St. John's Ambulance Association (chief office, St. John's Gate, Clerkenwell, London, E.C.), that we owe in England a great debt of gratitude for its successful efforts to popularise ambulance and first-aid knowledge amongst the people. It is an offshoot of the Order of St. John of Jerusalem in England, and has for its object the giving of lectures and demonstrations of first-aid to the injured in accident cases, and the provision of ambulance *matériel* for use in accidents.

Medical men are employed to give a course of lectures in first-aid in accidents, and in nursing. A regular syllabus is laid down; an examiner is sent down to hold examinations, and on his report certificates of first-aid or nursing are issued to the successful candidates.

Ambulance *matériel* is supplied by this association to many hundred places in England; but truly its important work is the education in the first principles of help it is giving to the people generally in all that concerns the human body. After considerable experience as an examiner, we can safely say that it has spread the first rays of the light of knowledge amongst thousands of people of every class, from the highest to the most humble in the land, and its work has been entirely for good. We feel quite certain that any medical man who takes up these classes in his town or village will be conferring a real benefit upon his district. Laymen of great intelligence and occupying prominent positions have frequently stated, that in any previous mistakes they made in giving help to sufferers, it was entirely their ignorance that was to blame. We have not taught the people enough, and it is to the credit of the St. John's Ambulance Association that they have fought the good fight, and victory is now theirs. To Colonel Duncan, Mr. John Furley, Mr. Barrington Kennett, and the hardworking secretary Captain Perrott, a national debt of gratitude is owing. Any further particulars as to formation of classes, method of work, and supply of ambulance *matériel*, can be had of the Secretary St. John's Ambulance Association, at St. John's Gate, Clerkenwell, E.C., London.

The London Ambulance Service.

In 1882 a movement to start a "London Ambulance Service" was originated, and is now at work in a small way. H.R.H. the Duke of Cambridge is President of the Committee; Mr. J. H. Crossman, Chairman; and Mr. Haggard, Secretary London Hospital, is Honorary Secretary. It has for its aim the provision of ambulance sick-transport carriages for London by means of public subscriptions. It has already supplied Howard's pattern of sick-transport carriages to Stoke Newington Police Office, to Fulham Police Office, and also to Lambeth Police Station. A hand-

ambulance, covered in, and built on Howard's system, has also been supplied to Stepney Parish, and the Vicar informs us it has been of much use. In all cases where these ambulances are supplied, a minimum charge of 5*s.* is made, increasing with the distance to 10*s.*

It will be quite evident that the poor are completely unable to pay such a sum, and even many people of that struggling body who form the lower middle class. One would like to see some charitable or municipal funds pay all charges in these cases, so as to lower the cost to that of an ordinary cab—or to abolish it altogether. As far as one can find out, the very existence of the "London Ambulance Service" is unknown to most people, and the London hospitals have not joined in any way in the movement. Further information can be obtained from Mr. Haggard, Secretary London Hospital.

Provincial Ambulance Associations.

There is an Ambulance Association at Glasgow called the St. Andrew's Ambulance Association. It works an arranging ambulance instruction for the people, and the provision of sick-transport waggons and *matériel* for the use of the public in cases of accidents or illness. Office, 93, West Regent Street, Glasgow; Mr. W. M. Cunningham, Secretary, who will afford any further information needed.

In Edinburgh some steps are being taken to form a similar Association.

Continental Civil Aid Societies.

Professor Esmarch, after studying the St. John's Ambulance Association system in England, has started a "Samaritan Society" on the same lines, with Kiel as its centre, from whence the movement is spreading over Germany.

Baron Mundy is the founder of a society on somewhat similar lines at Vienna.

CHAPTER V.

PERSONAL "FIRST-AID" EQUIPMENT.

The Surgical Havresack—Water Bottles—Field Companions—The Soldier's first Dressing—Means of carrying it—Identification Label —Esmarch Triangular Bandage—Esmarch's Braces.

THE difficulties of transport in war, and the sudden needs of "first-aid," in peace, renders it essential that a certain amount of *matériel*, in the shape of instruments and bandages, should be carried by the ambulance staff of an army, and by the individual fighting soldier himself in war time, and that in peace readily adopted means of aid should be more generally available. Thus in war, scabbards, bayonets, stirrup-leather, rifles and other articles are used as splints ; just as in peace, garden-palings, rolls of paper, and walking-sticks are utilised.

In our army every medical officer carries a case of instruments in a pouch worn over the left shoulder. With every battalion and battery, small portable medicine cases, called "Field Companions," are found. These contain compressed drugs, restoratives, bandages, and the materials needed in first dressings.

With the bearer companies a regular havresac, called the "Surgical Havresac," and containing bandages, restoratives, a simple dressing-case, and tourniquets, is found.

This valuable aid is only issued to one-fourth of the number of bearers ; but it should be issued to every one of all ranks in the bearer company, and each regimental bearer should likewise have one. They are made by Savory and Moore, of New Bond Street, and cost about £3 each.

Water-bottles are also carried in certain proportions by the bearers ; but we would like to see every bearer, without exception, so equipped.

The method of carrrying the surgical havresac and water-bottles is shown in the picture on the title-page.

In Continental armies knapsacks containing very much the same *matériel* as is found in our "field companion" are much used, and for cavalry special saddle-bags (*sacoches*

Fig. 6

FIELD COMPANION FOR PORTABLE DRUGS AND FIRST DRESSINGS.
(*From Surgeon-General Longmore's Book, 'Gunshot Injuries.'*)

d'ambulance) are issued containing like equipment. In our army the cavalry first-aid appliances of every kind are very defective, and it will be interesting to note foreign equipments of this kind sent to the Exhibition. In our army a certain number of the fighting soldiers carry a bandage and

some dressing, either in their havresac or in their pockets. This most important help to the wounded in war needs to be completely and definitely dealt with in our service. Unless a distinct pouch is made for these dressings, they will never be either clean or available. There is room on the waist-belt, between the ammunition-pouch and the bayonet-frog, on the left side for a very small leather pouch, about four inches in breadth by six in depth. Such a pouch, kept in store in peace, should be issued in war to every fighting-man. It would contain an Esmarch triangular bandage, a roller bandage, some lint, oiled silk, and such antiseptic dressing as may be desirable. All these articles would be pressed by force into a small bulk, and placed in a waterproof cover in the pouch, and with them the absolutely essential "identification label." This would be a calico label, like that used for marking luggage; and when the war began, it should be filled up with all the particulars of the man's name, number, and regiment, so as to avoid delays and mistakes made on the field when men are wounded and faint, and cannot speak distinctly, or indeed, at all, at times. It should have counterfoils to the slip for the regimental surgeon, the bearer-company adjutant, and the field-hospital adjutant. The surgeon should only have to fill up the particulars of the wound on the field, all else being filled up leisurely at the beginning of the campaign.

IDENTIFICATION LABEL TO BE CARRIED BY THE SOLDIER IN THE BANDAGE POUCH.

Field Hospital Adjutant. (*Keep this.*)	Adjutant Bearer Company. (*Tear off.*)	Regt. Surgeon. (*Tear off.*)
REGT.—1st Battalion King's Own Borderers. NO.—4239. NAME.—Private Thomas Atkins. WOUND.— .. .. — day of ——, 188–. Surgeon ——.	REGT.—1st Batt. K. O. B. NO.—4239. NAME.—Pte. Thos. Atkins. WOUND.—	REGT.—1st Batt. K. O. B. NO.—4239. NAME.—Pte. Thos. Atkins. WOUND.— .. .. ..

The label would be three times this size.

When hit, the regimental surgeon would fill up the main portion of the label, and tear off the regimental surgeon's slip for his own information. The adjutant of the bearer company would do the same with his slip, and thus fuller and clearer information would be obtained, and also the dead distinctly identified.

The Esmarch triangular bandage, now well known to ambulance students, should form part of all field-dressings; it is so useful for slings and head-bandages.

Professor Esmarch has also invented a pair of braces

Fig. 7.

ESMARCH'S TRIANGULAR BANDAGE FOR FIELD DRESSING.

which can be used as an elastic tourniquet for stopping bleeding.

There will probably be further developments of this idea as time goes on, so that one day interchangeable articles suitable for ordinary life and for surgical aid may be common. It will be remembered that the existing crimson sash of infantry officers was originally introduced for use as a hammock to carry the wearer when wounded off the field.

As far as regards the uniform of the ambulance staff of the various European armies, it is possible that one day an

international medical dress may be decided upon by an international conference. There would be advantage if medical officers and their men could be recognised at once, no matter to what army they belonged. In this, as in many other points, the system of ambulance-aid in war is quite in a germ condition.

The uniform decided upon for ambulance wear should be easy, free, and rational, and free from all tightness and display. The dress of women who desire to serve in war hospitals should also be completely rational, and all extra articles needing washing reduced to a minimum. The present outdoor dress of army nurses is certainly not suited for war service.

CHAPTER VI.

AMBULANCE SICK TRANSPORT APPLIANCES CARRIED BY MEN.

STRETCHERS, HAMMOCKS, DHOOLIES.

The Faris Stretcher—Baron Percy's Stretcher—An Ideal Stretcher—Furley's Lowmoor Jacket—Hammocks—Dhoolies—Dandies—Need of Stretchers in the Streets.

The one great essential in all ambulance aid is some means of carrying the injured person from the scene of his injury to the hospital. This is provided in the "stretcher," which consists practically of two side poles, and a sheet of canvas stretched between.

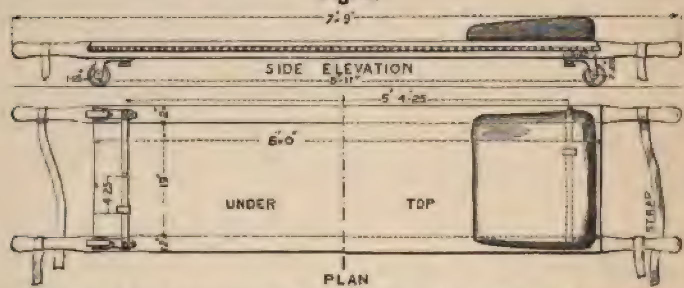
The "Early English" stretcher used in the Crimean campaign was simply of this pattern. There were two side poles kept apart, when open, by two iron rods called traverses, and a canvas sheet for the wounded man to lie upon. If the traverses were unhooked, the poles came together, and the stretcher could be rolled up into a small space. It had no legs, so that, if laid upon wet or stony ground, the canvas did not protect the patient, and there were no slings.

To the invention of stretchers there is literally no end. Their name is legion. Every modification of hinged and folding-up mechanism has been tried, some light and some heavy, and some mere curiosities of structure. It would be impossible to notice them farther.

The present regulation stretcher of the English army is known as "Surgeon-Major Faris's Stretcher." It is most solidly built, and consists of two side-poles of ash, brown

canvas bottom, a pillow, two self-locking traverses, which lock under the stretcher and keep it open. There are four wheels of *lignum vitæ*, on which the stretcher rolls into the ambulance waggon, and which act as legs when used as a camp bedstead, a use to which all army stretchers are liable. It weighs 32 lbs., and costs at the Royal Arsenal, Woolwich, about £3. Carter & Co., 47, Holborn Viaduct, London, can supply it at the same price.

Fig. 8.



ENGLISH ARMY REGULATION STRETCHER, 1884 (*Surgeon-Major Faris*).

To aid the bearers it has two leather slings, one at either end, which the bearers put over their neck like a milkman's yoke, and so relieve their arms of part of the weight.

Fig. 9 is a picture from Surgeon-General Longmore's book of a field stretcher, designed by Baron Percy, and the equipment of the stretcher-bearers themselves is also shown.

It will be seen that the stretcher, when not in use, is divided between two bearers, who, when it is to be used, rig it up by passing the poles through the wooden end-pieces carried over the knapsack, and put on the canvas bottom.

It would be absurd to think that we have in any way arrived at finality in our stretchers. We have little doubt that a stretcher will one day appear, to which the existing pattern will bear the relation of a country cart to a bicycle. The stretcher we may see will not be designed either by an

ambulance amateur or an official artillery carriage-builder, but rather by a skilled mechanical engineer, well acquainted

Fig. 9.

BARON PERCY'S STRETCHER ; BEARERS IN MARCHING ORDER.
(*After Longmore.*)

with steel and it uses, and knowing what is needed to be produced. The men who have built our spider's-webs, called

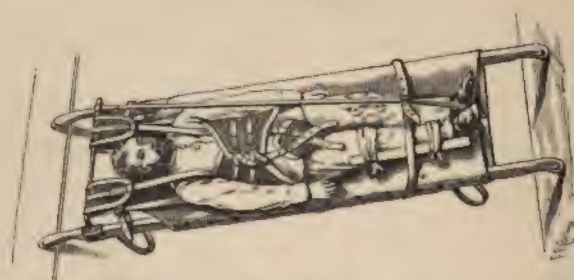
Fig. 10.

THE SAME, WITH STRETCHER FITTED FOR CARRYING WOUNDED.
(*After Longmore.*)

bicycles, must surely be able to construct a light and useful field stretcher. It should be so light as to be carried by one

man with ease when folded up; the side bars or poles should be of steel, so strong as not to yield if used as a camp bedstead. The canvas should be detachable, so as to be easily cleaned, and perhaps carried by the bearer, rolled up like a soldier's great-coat. The traverses should be light, yet strong enough to keep the sides firmly apart. The legs would need careful study, and all the parts should be completely interchangeable. The pillow need only be an empty case, buttoning up, and ready to be filled with hay or grass in the field. The leather slings could be replaced by light steel chains, so strong as to hold up the stretcher and the patient, if the stretcher was hung up in a luggage van for travelling. The weight should not be more than 15 to 20 lbs., if so much.

Fig. 11.



FURLEY'S "LOWMOOR JACKET," FOR USE IN MINING ACCIDENTS, ETC.

While writing of stretchers, we may here describe FURLEY'S LOWMOOR JACKET, which seems to be a singularly useful article. In the shafts of mines, sewers, and other narrow places, it is not possible to remove an injured person in the recumbent horizontal position.

Mr. Furley has designed a jacket which encircles the injured person's chest and abdomen, and which has strong back pieces which run up behind the patient's back, and cross over an iron bar, which is slipped by iron rings over the handles of the stretcher. There is also a strong support passing between the legs, and fastening to the jacket. The legs are kept in their place by a strap—and

additional support is given by a web-stirrup, into which the sound foot can be slipped if desired.

The patient can thus be drawn up vertically out of the mine or sewer, or lowered into a boat, without injury to the wounded part.

Extempore stretchers are made out of rifles and soldiers' great-coats, or the valise may be hung between two rifles and a kind of stretcher so improvised. A number of improvised seats for carrying injured men have been previously pictured—vide Fig. 2.

HAMMOCKS have been frequently used to carry injured persons. They are quite unsatisfactory for such a purpose, as the sides close in very much when slung, and they offer no secure resting-place in case of broken limbs. After the battle of the Alma, many of the wounded were carried to the shore in hammocks slung on oars; but this wretched makeshift is only permissible when, as on that occasion, regular ambulance arrangements were completely absent.

In mountainous countries various methods of carrying sick and wounded in baskets or chairs borne on the backs of mountaineers are in vogue. The patient faces to the rear, and sitting in the chair, is carried over the ground like an ordinary load.

In Eastern countries, where wheeled-carriages, owing to bad roads, cannot travel smoothly, there is an immense variety of means of human transport by bearers. Any one who has travelled in India will remember the many patterns of such conveyances that exist.

There is the Dhoolie, a closed-in litter, carried by four bearers, with two others as a relief. This highly commodious means of carriage has formed the staple sick-transport in all our Eastern wars. Carriage for 10 per cent. of an Indian army is generally allowed during a campaign, and this would imply some 600 bearers with a fighting battalion 1000 strong.

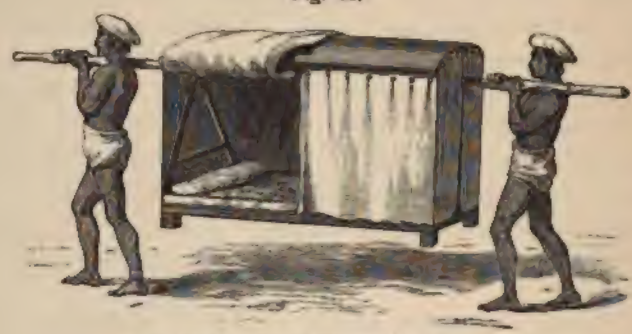
To-day in India the dhoolie-bearer class is gradually disappearing before the progress of railways and horse-conveyances, and it may be necessary as time goes on to

preserve the caste absolutely for military purposes, as around our Indian frontier wars are almost perpetual, and the dhoolie-bearer is much needed.

There are many modifications of the dhoolie in existence, and the number of new dhoolies invented is considerable. Surgeon-Major Bourke, of the Army Medical Department, has invented a dhoolie which fulfils many needs. It can be used as a stretcher, and a hospital bedstead as well as a dhoolie, and the poles and covers of a few dhoolies form also a tent for the sick.

The DANDY, a cot slung from a pole, and carried by two men, with two more as a relief, was much used in the

Fig. 12.



THE INDIAN DHOOLIE. (*After Longmore.*)

second Affghan war, and it will probably be as much utilised in future campaigns.

Dhoolie-bearers accustomed to the plains dhoolie carry the hill dandy with ease.

Palanquins and jhampans are modifications of the dandy and dhoolie, types common in India.

We have in an earlier chapter recommended that stretchers should be kept in every street in our great cities, in a "stretcher-locker," of which the police and certain residents should have keys. Every railway station should also have one, also every guard's-van in all passenger trains. No public school, factory, institution, or asylum

should be without such aid in carrying injured people. Probably many chemists would be glad to keep such stretchers in their pharmacies, and exhibit a notice to that effect in their windows, if any philanthropic society would provide the article.

But in the end, municipal, parochial, or Poor Law district governing bodies will be made responsible for this important work.

CHAPTER VII.

AMBULANCE SICK-TRANSPORT CONVEYANCES WHEELED BY MEN.

English Military wheeled Stretcher—The Ashford Litter—Neuss Litter with wheeled support.

WITH the view of diminishing the number of bearers and attendants employed in transporting sick or injured persons, various patterns of wheeled-stretchers have been designed. They are mainly of use for civil purposes where

Fig. 13.

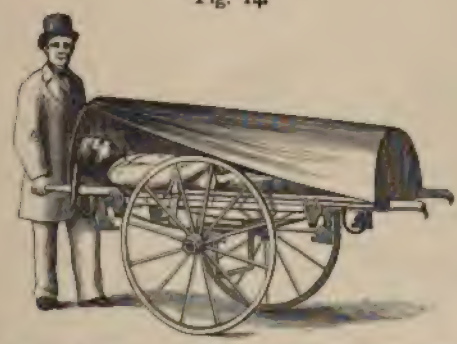
MILITARY STRETCHER ON WHEELED SUPPORT.
(*From Surgeon-General Longmore's 'Gunshot Injuries.'*)

in cities or towns good level roads are available, and the jolting which would be caused by uneven tracks reduced to a minimum.

For military service a pattern of a wheeler stretcher is sealed. The stretcher is detachable from the wheeled support, and when loaded, one man can thus wheel one patient. In the field where battles have to be fought over every kind of broken ground, these stretchers are of little use, and no records exist of their being used to any extent in any army.

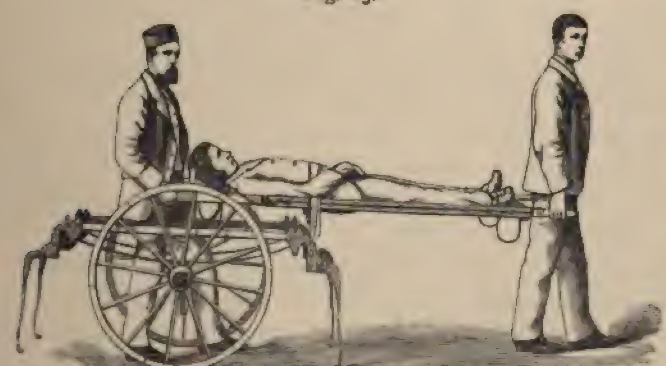
The Ashford litter consists of a folding stretcher with

Fig. 14.



FURLEY'S ASHFORD LITTER. THE STRETCHER, WITH COVER, PLACED ON THE WHEELED SUPPORT.

Fig. 15.



THE ASHFORD LITTER. THE STRETCHER DETACHED FROM THE WHEELED SUPPORT.

pillow and removable cover, resting without any fastening on four small iron crutches, with an under-carriage of two wheels on elliptical springs.

This litter has the advantage of a crank-axle, enabling the bearers to pass with the stretcher between the wheels, so that lifting over the wheels is avoided. The stretcher by itself costs two guineas, and the litter, complete, ten guineas. It can be obtained at the Director of Stores, St. John's Gate, Clerkenwell, London, E.C.

Fig. 16.

ST. JOHN AMBULANCE LITTER, COMPLETE ON WHEELED SUPPORT.

The St. John Ambulance Wheeled Litter. Price £16. Weight: complete litter, 1 cwt. 2 qrs. 14 lbs.; truck, separate, 3 qrs. 7 lbs.; litter, separate, 3 qrs. 7 lbs.

This litter is the invention of Messrs. Neuss, of Berlin, and was first employed by the Prussian *Johanniter Orden* (Knights of St. John), during the Franco-German War, where its practical advantages in alleviating suffering first became apparent. Considerable attention has been paid in the design of this litter to secure an easy and steady position for a patient while being transported in it. The patient does not lie in a completely horizontal posture; his head and back are somewhat raised, and inclined at an

angle with the pelvis and thighs. The head of the patient rests upon a pillow covered with glazed cloth or leather; the back, pelvis, thighs, and legs upon a flexible support of painted sail-cloth. There are two padded supports for the arms and elbows of the patient. A folding sail-cloth hood is fixed to the upper end of the carriage, and can be drawn over the head and shoulders of the patient, so as to form a sun-

Fig. 17.

STRETCHER DETACHED.

shade or protection against rain, without interfering with the free access of air. A cover of sail-cloth is also rolled up, and fastened by two straps at the foot of the litter. This covering, when unrolled, can be drawn up so as to lie under the upper edge of the expanded hood, and be fastened to the upper part of it. By these means the patient, during transport, can be protected against dust or inclement weather on every side. Under the part which is made to support the head and shoulders of the patient there is a wooden receptacle capable of carrying refreshments, bandages, or other parcels, or of receiving any articles belonging to the injured man who may have to be transported to the hospital. To facilitate the litter being

carried upstairs, into the wards of an hospital, or into the narrow alleys of a town, the stretcher is made to be easily detached from the iron frame. When so detached, it is kept off the ground by four short iron legs, which are fixed to the side poles at the head and foot.

This litter can be obtained from the Assistant Secretary, Order of St. John, Clerkenwell, E.C.

Those who desire further information concerning wheeled litters should write to the firm of Lipowsky-Fischer (Manager: C. Maquet) of Heidelberg, for their copiously illustrated catalogue of ambulance equipment of various kinds. It contains a vast number of interesting ambulance and invalid-furniture illustrations.

CHAPTER VIII.

AMBULANCE EQUIPMENTS CARRIED BY MULES OR HORSES.

Need of good Mule Equipment for our varying wars—The English Medicine Panniers—Mule Cacolets—Mule Litters—Ideal Mule-loads for a Field Hospital.

PACK-ANIMALS have always been much used with armies in the field. They can travel on any mountain path, and it is essential to have much of the *military* medical *matériel* of such description as can be carried easily in this manner. The English army is still deficient in good mule equipments from a medical point of view. We have no field hospital equipment regularly organized for mountain campaigns, or for countries which, if not mountainous, are not traversed by regular roads.

Practically if we once had a good mule-borne mountain hospital equipment it would almost completely equip us for our own little wars, for we have only to give a mule pannier to two coolies to carry in campaigns like Ashanti, or to hang two panniers over a mule as in Affghanistan, or to pack four panniers on a Maltese cart for a campaign like Egypt or the Soudan, and to stow away 8 or 12 mule panniers in a field waggon for any European war. If once we could so equip a 25-bed unit hospital, the difficulties of our many wars would be solved; for, after all, a 200-bed hospital only needs eight 25 bed-units of equipment. We would need a pair of mule-panniers completely equipped as a cook-house load. Its pots, pans, and various utensils, complete for 25 men and the load itself, forming a distinct unit. We also need a 25-man clothing-load, viz. towels,

sheets; and feeding-utensils, plates, knives, cups, salt-cellars, for 25 men. Eight such loads would equip a 200-bed hospital.

We also need an "office pannier," containing all the records, stationery books, forms used in war-time. The

Fig. 18.

MEDICINE PANNIERS CARRIED ON A MULE.
(*From Surgeon-General Longmore's 'Gunshot Injuries.'*)

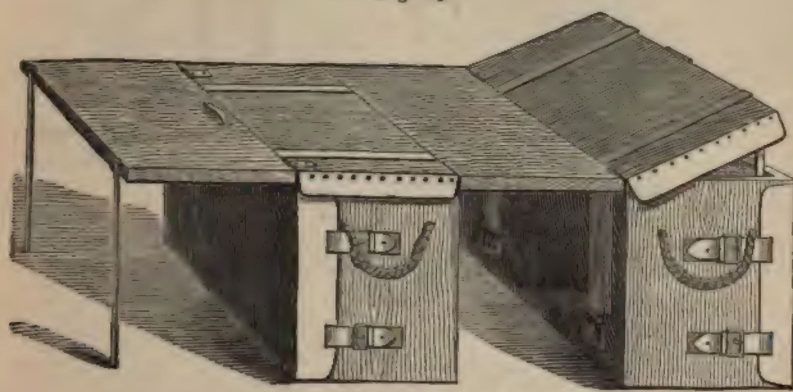
panniers themselves forming a writing table and a seat, as needed.

We also most urgently need a "Conservancy load," consisting of the picks, shovels, latrine-vessels, bed-pans, latrine screens—needed, and so urgently needed, by the sick in war time—the frame to form the latrine seats and to

enclose the vessels on the march. We also need a portable operating table of a simple kind, to be carried by a mule, and our loads of blankets, and waterproofs, could easily be made of suitable bulk for mule carriage, which is about 80 lbs. for each side box, or 160 lbs. to 180 lbs. for a mule.

It is hardly credible that in India, where we have been so long campaigning, that no defined field hospital mule equipments exist. The want of such equipments was much felt during the Affghan war. Towards the end of the same campaign, mule hospitals, as mobile as mountain batteries, were ready with the army, but they grew up under many

Fig. 19.



MULE PANNIERS ARRANGED TO FORM AN OPERATION TABLE.
(*After Longmore.*)

difficulties, as no code exists defining their correct organization.

The English medicine panniers for mule carriage are probably our best unit of medical equipment. They are carried on either side of a mule or pack-horse, and when placed on the ground form an operating table if opened out. They cost at Savory and Moore's, £48 10*s*. per pair.

These articles, which carry only medicines and dressing, should be the model of the unit of the future to which all our field equipments should be reduced. It could then be possible for the staff of a war hospital to carry their own

Fig. 20.

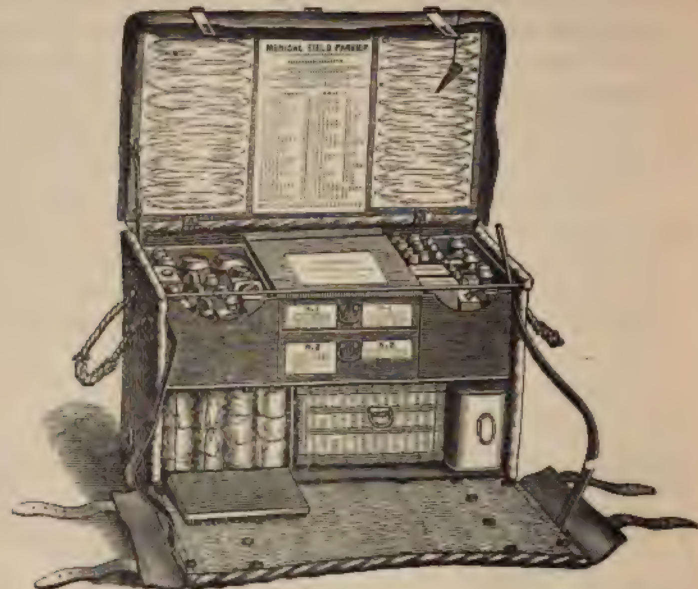


Fig. 21.

MULE PANNIERS OPEN TO SHOW CONTENTS. (*After Longmore.*)

equipment on board ship, with themselves, and so disembark in an enemy's country. To day our equipment is singularly cumbrous. Reduce it to mule units, and all will be well.

For the carriage of wounded two different mule equip-

Fig. 22.

MULE CACOLETS OR CHAIRS. (*From Longmore's 'Gunshot Injuries.'*)

ments are used. Cacolets (*caque au lait*), copied from the Pyrenean dairy folk, are really slung chairs hooked on to a pack-saddle, and the wounded sit on either side of the animal. A pair of cacolets weigh about 56 lbs., and cost about £5 per pair.

The mule litter, or *litière*, is really a slung couch carried

on either side of a mule, and supports a person at full length lying down. A pair of litters empty weigh 106 lbs., and cost about £19.

Opinions differ as to the value of both those articles, and doubtless much depends on the training of the animal used. If the mules be unbroken, great risks occur to the

Fig. 23.

MULE LITTER WITH WOUNDED SOLDIER. (*After Longmore.*)

sick, and many men have been thrown out by a kicking animal.

During the recent Egyptian war a new departure was made in this branch of ambulance work, by utilising horses for this purpose, and it is to be hoped that trained cavalry horses will in future be largely utilised instead of mules for our cacolets and litters, leaving mules for pack-carriage proper.

Every regiment of cavalry in our army should have two

cacolets per troop regularly fitted to its troop-horses, and four or more litters for the regiment. At present our cavalry ambulance equipment is very defective, and it will be interesting to study foreign systems of help to wounded troopers.

If English mechanical genius could solve the problem of how to carry our severely wounded men lying at full length along the back of a horse, a great boon would be conferred on humanity.

There would be difficulty in achieving this arrangement, but it should not be impossible. Any one who desires to bestow a boon on an English army should offer a prize for the best cooking-appliances load capable of being carried by a mule, able to utilise wood as a fuel, and divided into two portions for either side of an animal, neither weighing beyond 80 or 90 lbs. It should carry all things needed for cooking for 100 men, or say 50 men on either side.

A "conservancy" load carrying all latrine arrangements would also be a real boon to the sick soldier. The other articles of nursing and feeding appliances are not difficult to stow away in any empty mule pannier-box that may be sealed as a pattern.

Water supply is always a difficulty in mountain campaigns, and for this purpose either small barrels are used, fitting on the pack-saddles of the mules, or large leather bags, called in India *puckalls*, are used. These are slung over the pack-saddles, and so water is carried. It is advisable to spread a tarpaulin over the saddle, to save it from damage by the water. A pair of iron tanks made to fit the mule-saddle, and made available in camp by adding a wheel and a pair of handles, might be utilised as hand water-barrows. All tents used for mountain campaigns should have their poles cut and socketed for use, so that in passing through defiles the ends may not catch against the rocks. In all that concerns mule equipment for warfare we have in the Indian mountain batteries singularly perfect models for us to copy. A more workmanlike unit does not exist in our English army.

CHAPTER IX.

CAMEL CARRIAGE.

Camel Kadjawas— Bryce's Camel Dhoolie.

CAMELS are used throughout the whole of the East for the carriage of human beings as well as goods.

For the carriage of sick they have been utilised; but they are not an agreeable means of travelling for a sick man.

In the Affghan campaign, several convoys of sick and

Fig. 24.

CONVOY OF SICK IN CAMEL KADJAWAS, AND IN BRYCE'S CAMEL DHOOLIE. (*After Longmore.*)

wounded were sent down in camel *kadjawas*, but they are more useful for convalescent than for those actually sick. Here is a picture showing a camel convoy on the line of march, and one of the camels has a pair of Bryce's camel

dhoolies—an attempt at providing lying-down accommodation for a sick man on the line of march.

The fact is, no study has of late been given to devise suitable camel-carriage for the sick, and it is in an entirely primitive condition. It should not be impossible to devise a well-balanced camel-litter or dhoolie, in which a sick man could lie at full length, and which by some suspension system would counteract the swinging motion of the camel. When it is remembered that to carry two sick men in two dhoolies twelve bearers are needed, and that all their kit has to be separately provided for by other means of transport, and that if two or three bearers get sick, the whole gang break down, it is essential not to lose sight of some means of utilising camel-carriage for Eastern campaigns.

CHAPTER X.

WHEELED AMBULANCE EQUIPMENT AND SICK-TRANSPORT VEHICLES DRAWN BY HORSES.

Ambulance Equipment Waggons—The Surgery Waggon of the Bearer Company—The Pharmacy Waggon of the Field Hospital—The Store Waggon of the Field Hospital—The Kitchen Waggon of a Field Hospital—The Water Cart—The Laundry Waggon—The Electric Light Waggon—The Army Regulation Sick-transport Waggon—Its construction—The Austrian Red Cross Sick-transport Waggon—The United States Rucker plan of arrangements of Seats and Stretchers—Civil Ambulance Sick-transport Waggons — The Howard Sick-Transport Waggon — Davy's Ambulance Waggon—The Furley Sick-transport Waggon—The Atkinson-Philipson (Newcastle) Sick-transport Waggon — Infectious-disease Sick-transport Waggons.

In all civilised countries where made roads are found, wheeled vehicles drawn by horses will always be the most important element in conveying aid to the injured, and in conveying the injured themselves to a place of shelter.

These wheeled vehicles divide themselves into two main classes : viz. ambulance *equipment* waggons, and ambulance *sick-transport* waggons ; the former being the conveyance used to carry the supplies, medicines and appliances needed for the relief of the sick, the outfit of the hospital, the medical stores, the water supply, the cooking arrangements, and all the various details of hospital interior economy ; while the ambulance sick-transport waggons are intended for the carriage of wounded or diseased men only. We shall deal with the ambulance *equipment* waggons first in order.

A. Ambulance equipment waggons.

The various waggons included under this head may be detailed as follows.

1. The Surgery Waggon of the Bearer Company.
2. The Pharmacy Waggon of the Field Hospital.
3. The Equipment Waggon of the Field Hospital.
4. The Kitchen Waggon of the Field Hospital.
5. The Water Cart of the Bearer Company and Field Hospital.
6. The Laundry Waggon of the Field Hospital.
7. The Electric Light Waggon of the Ambulance Column.

The Surgery Waggon of the Bearer Company.

If we were asked to say what vehicle in the medical corps of an army in the field is, after the ambulance sick-transport waggon, for the wounded soldier the most essential, we should say the surgery waggon of the bearer company.

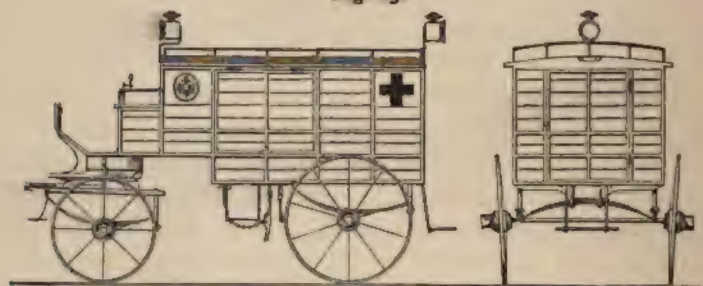
It is in this waggon that in all modern armies is carried those first essential articles of equipment needed to establish the all-important dressing station. These articles would be the operating tent to shelter the patient and the surgeons during the operations; the operating table itself, the surgical knives and bandages, the all-important cooking utensils for the life-saving soup, and such blankets as may be needed to shelter the wounded if they lie on the field at night.

The reader must remember the functions of the bearer company, and must study its position in the war diagram forming the frontispiece. It is to the bearer-company dressing-station all the divisional wounded are carried for further dressing and for food. If this waggon be incomplete, the wounded in their hour of supreme suffering will not be suitably cared for. If it be complete, all that is urgently needed by the surgeons will be there.

In our army we use an ordinary general-service (lock-under) waggon, used in the everyday transport work of the service as our surgery waggon. The vehicle is identical, it is its contents which are peculiar.

All the equipment is detached, and is merely packed in boxes and baskets into the waggon, and in this procedure we must all agree. So peculiar and so different are all our English wars, that all specially fitted waggons must be reduced to a minimum, and our loads of every kind be reduced to the mule-carrier standard, and so packed into varying waggons. The waggon then needs no special description; it is made to take to pieces and to pack up on board ship; it has four wheels (two lock-under), and is drawn by two horses, and may either be driven postillion fashion or from the box. It costs at Woolwich Arsenal,

Fig. 25.



SURGERY WAGGON OF THE AUSTRIAN RED CROSS SOCIETY, BY LOHNER OF VIENNA.

empty and unequipped, £127 12*s.* and weighs empty about 17 cwt.

The Operating Tent supplied to the surgery waggon is an ordinary bell tent of the army pattern, price £5 5*s.* It is light, it is true, but it has no other special qualifications. It is quite unfit for operating in, for the doctors have not room to turn in it, and the central pole is in the way.

In the German service a special pattern of "operating tent" is issued; it has a ridge pole, two upright poles, and can have one side raised like a verandah, forming an open shelter for the operating work.

Fig. 25 is a picture of the surgery waggon of the Austrian Red Cross Society, made by Lohner of Vienna. By comparison with our English surgery waggon it is light

and very easily moved. It does not take to pieces like our waggon. It costs, without any fittings, 750 florins, Austrian. We have here a plate of the same waggon, with its operating tent pitched over the waggon, turning the whole space into an operating theatre. This system of arrangement is criticised, as of course we cannot always secure ground suitable for the waggon and the tent. But the plate shows the size and character of the operating tent and how much more suited it is for the surgeon's work. Some such tent is needed in the English service. The price of this Austrian tent is 400 florins, Austrian currency.

Fig. 26.

SURGERY WAGGON OF THE AUSTRIAN RED CROSS SOCIETY, SHOWING THE SPECIAL OPERATING TENT PITCHED OVER THE WAGGON.

The Operating Table.—Two kinds of operating tables for ambulance work exist in our service; one pattern for the bearer company, and one pattern for the field hospital. The latter, which costs 10 guineas and weighs 77 lb., is very elaborate, and is modelled on civil peace-hospital operating tables; the bearer-company table is like an ordinary camp table, folding up in a compact way, and it seems quite useful enough for war work. It can be used as an ordinary office table if not needed for its special duty, and this is an important fact to be remembered, for, despite the popular idea to the contrary, army surgeons are not always operating, and a table that would be interchangeable seems to us to be more generally useful for war work. Price of operating table of bearer company, £3 10s; weight, 52 lbs.

The instruments, medicines, medical comforts, cooking and feeding equipments are all carried in eleven separate boxes or baskets, which fit in two layers into the waggon. Some of these boxes and baskets are of extraordinary dimensions; the F basket, which contains the reserve dressing, being amongst baskets a very leviathan, and not suited for many of our frontier wars. In the ideal surgery waggon, every box and basket should be ruthlessly cut down to mule-pannier size (80 lb. weight), the number of them if needs be increased; but with our petty wars we must have a general service equipment, and our loads must be available for coolie carriage, mule carriage, &c., and waggon carriage. This can only be done by choosing a small general service unit of size and weight, and fearlessly compelling all loads to be modelled upon it. Such a surgery waggon with uniform mule-pannier loads can be very easily produced, as only a few baskets and boxes need change.

It is impossible to dwell too much on the need of having efficient and ready means of cooking broths for the wounded. This battle-field aid is all-important, and whatever develops it should be encouraged. The baskets of the bearer-company surgery waggon, empty, cost £46 15*s*., and are supplied at present by Savory and Moore, New Bond Street, London.

The A, B, and C canteens cost about £23, and the two medical-comforts boxes about £7 5*s*.

2. *The Pharmacy Waggon of the Field Hospital.*—This is found in most European armies. It is the general medicine store and dispensary of the field hospital, and the waggon used in our army is singularly complete in every detail, and well worth studying. It is somewhat like a baker's cart with covered-in roof, and has numerous drawers and slides holding drugs and dressings. There is a dispensing table at the rear of the waggon, and a pent-house cover over it. Its price without the drugs or instruments is about £217. In this, as in all war equipments, we must measure all things by our peculiar campaigns. We English,

with all our humanitarian ideas, are the great fighting nation of the world. Our temple of Janus need hardly have any gates, so rarely do they need closing. This constant warfare means constantly changing war conditions, and hence we need again the interchangeable unit. However much we may wonder at and admire the pharmacy waggon, we seem compelled to say "C'est magnifique, mais ce n'est pas la guerre." It is heavy (weight 18 cwt. 3 qrs. empty), and perhaps top-heavy. But its prime defect is that its contents cannot be taken out and loaded on mules, or carried by coolies, if the waggon breaks down, and these are the true tests for our varying wars. Probably several sets of mule medicine-panniers, containing the same amount of drugs, would be more generally useful, and would do for Egypt, Ashanti, or Affghanistan, and would suit, when packed in a waggon by the dozen, for a European campaign.

3. *The Field-Hospital Store-Waggon* contains all the bedding, feeding utensils, and cooking arrangements for fifty sick. It is a four-wheeled, two-horsed, "lock-under," general service waggon, with some slight alterations to suit its special work. In this, as in all war-equipment waggons, the 80 lb. mule-pannier unit should be as far as possible the rule. Price, £151. Weight, 20 cwt. 34 lbs.

4. *The Kitchen-Waggon of a Field-Hospital* is a special waggon which does not exist in the English service, but is found in several European armies, for cooking for the sick and wounded. It is generally made of two sizes, one to cook for 200 men, and the larger size for 400 men. The former is an arrangement of boilers, with a furnace or grate below, mounted on wheels, and drawn by one horse. The cooking is done in the open air, and can be done on the move as the column marches. In the larger size waggon the cook stands in the waggon, and it is really a small cook-house on wheels. This latter vehicle is for English wars quite out of the question, but it is probable the 200-unit cooking or kitchen-waggon could be utilised if made to pack on mules. Those desirous of studying this

kitchen-waggon question further will find pictures and description of both such vehicles in the (' Freiwillijer Sanitats-Dienst in Kriege '), being the official handbook of the Sovereign Order of the Knights of Malta (of the Bohemian Langue.) Vienna, W. Seidel & Sons, 1879. The cooking-waggon or portable field-kitchen in use by the Swiss medical service seemed to me to be light and portable. It may perhaps be in the Exhibition.

5. *The Water-cart of the Bearer Company and Field-Hospital.*—Water-carts of the general army pattern are supplied to field-hospitals and bearer-companies. They are simply wooden hogsheads (108 gallons) on a wheeled stand, Maltese cart (mark III.), very like ordinary civil water-carts. They are drawn by a pair of horses. Every field-hospital and every bearer-company has two such carts. In our Eastern wars skins are largely used for water-carriage, and the human water-carrier, or *bihisti*, is a conspicuous figure in every Eastern campaign. He carries water in a goat-skin *masak* borne upon the hips. He takes his place in the fighting-front of the line, and is often one of the most popular men attached to a company.

The water-barrel of the English army water-cart is very difficult to cleanse within—this can only be done by taking out one of the heads. The number of taps also is not sufficient to ensure rapid filling of many water-bottles. In warm climates, if not in daily use, the hogshead warps, and is not serviceable for some time, until the wood swells again.

Captain J. Jones, of the Royal Engineers, has designed a water-cart consisting of a galvanised-iron tank, mounted upon a Maltese cart (mark III.). It contains 119 gallons. It has a man-hole with cover, for filling and cleansing the tank. An iron partition divides the tank within into two compartments, and the partition is pierced with holes, which allows the water to pass through gradually, thus breaking the rushing of the water about the waggon when the tank is partly full. There is one large tap and six small ones, thus allowing several water-bottles to be filled

at the same time, which is of great importance when many men have to be supplied.

For bearer-company work, and indeed for field-hospital service, a certain number of galvanised-iron cans with spouts should be hung on to the water-cart, for aiding in distributing the water to the bearers to fill their water-bottles ; a few drinking-cups of metal might also be attached by chains to the cart, as men drink slowly out of their bottles, but quickly out of open cups.

At the School of Engineering at Chatham water is distributed to the working parties in small kilderkins mounted in wheel-barrows. They are really miniature water-carts. A few such hand water-carts would be useful with a bearer-company or field-hospital. It should not be difficult to make an iron tank of such size as to be utilised for a mule pack-saddle water-barrel, to be borne in pairs on a pack-saddle, and to which tank a pair of removable iron handles and a wheel might be attached, converting the whole in a hand water-cart.

This wheelbarrow system could also be applied to the conservancy arrangements as suggested by Dr. Veale in the Egyptian campaign. The barrow to be utilised as a latrine receptacle capable of being wheeled away from the camp when necessary to be emptied, and on the march forming a mule load, or packing into the store-waggon of the field-hospital. We are merely on the threshold of many such inventions, which will be intensely useful in peace as well as in war.

6. *The Laundry-Waggon of a Field-Hospital.*—No one with any war experience will controvert the opinion that an efficient laundry with a good working staff is essential in all war-hospitals, be they field, general, or ship medical establishments.

We learned in the long Afghan campaigns to value the washerman and the conservancy man in the very highest degree. For sick men to become infested with vermin is lamentable, and against such suffering efficient laundry work is the only safe defence. In all general war

hospitals we must ever regard the laundry as needing very accurate and detailed organization before the army takes the field. Dr. Parkes dwells with great urgency on this point. Dr. Bleckley, in his hospital-ship report, also refers pointedly to it, and all war surgeons must echo the cry for laundry efficiency.

Up to the present time we can find no record of any army having a war-hospital mobile laundry, or laundry-waggon. European armies campaigning on the European continent can find in the conquered districts civil labour ready to do this work. The English medical service in this as in many other points is entirely dependent on its own previously organized resources. We find no local aid on Crimean steppes, in New Zealand fern-thickets, on Afghan mountain sides, nor midst the dense Ashanti jungles. We must in all cases arrange our laundry staff in England and carry them to the seat of war. We shall be the first nation probably to equip a mobile laundry-waggon, combining boiler, washing-machine, and drying closet. Dr. Parkes mentions that Mr. Hooper, superintendent of the Renkioi Hospital during the Crimean campaign, designed a laundry-waggon to accompany troops in the field. This was in 1856, and washing-machines were then in their infancy. To-day there would be nothing easier than to design a portable boiler, washing-machine, wringing-machine, and mangling-machine, all in one waggon; but as to the drying-closet, one is not so clear, but doubtless this too is not impossible. There may be some laundry-waggons in the Exhibition. It is difficult to over-rate the need of such an article of equipment with war hospitals. It should be so made that, on arrival in camp, the horse which drew the waggon should also furnish the motive power for washing the clothes, somewhat like a mill-horse system.

7. *The Electric Light Waggon of the Ambulance Column.* —Baron Mundy of Vienna, the well-known ambulance organizer, has applied the electric light to the searching of the battle-field at night for wounded.

A four-wheeled carriage contains the necessary apparatus, including engines and dynamos. It is quite mobile. The whole apparatus is manufactured by *Sautter-Lemonier*, 26 Avenue de Suffren, Paris.

Several demonstrations of this adaptation of the electric light took place at Vienna during the Electric Exhibition, and it is not unlikely we may have such a display in London during the Exhibition.

For military purposes in its wider sense such a waggon ought to be very useful, and it will probably be found to be much used in all future wars.

MILITARY AMBULANCE SICK-TRANSPORT WAGGONS.

In a mere primer such as these pages are intended to be it would be quite impossible to deal at any length with the voluminous subject of military sick-transport waggons. Those who desire to drink deeply of the stream of literature on this subject are referred to Surgeon-General Longmore's classic and exhaustive work on the transport of sick and wounded troops, published by authority and to be obtained at any military bookseller. Price 5*s.* In this work every variety of waggon of this and every other country is fully dealt with by descriptions and illustrations. Certain conditions are needed in English war sick-transport waggons, which Surgeon-General Longmore summarises as follows :—

1. There must be suitable springs, to diminish the shocks and force of concussions in passing over bad roads.

2. Provision must be made for men lying down as well as sitting up—that is, for seriously ill and for convalescing cases.

3. The carriage must take to pieces for embarkation in ships for foreign wars.

4. All parts of all waggons should be interchangeable.

5. Durability and lightness are essential in proper amount.

6. Water must be carried in the waggon ; also stretchers,

and some articles of surgical dressing and restoratives. Also means of carrying the arms and kit of the sick.

7. It must be covered from the weather, be it hot or cold.
8. It should be easily loaded with its sick.

Fig 27.

ENGLISH ARMY SICK-TRANSPORT WAGGON, SHOWING THE FARIS' STRETCHER RUN IN ON THE FLOOR OF THE WAGGON.—CENTRE BOARD NOT SHOWN IN ENGRAVING.

The English Regulation Sick-Transport (Ambulance) Waggon has four wheels. Two of large size (56 inches diameter) behind, and a smaller pair (36 inches in diameter) in front, locking under the carriage, and thus enabling it to

turn round on a small axis, and greatly obviating the risks of upsetting. Waggons which have equal wheels before and behind are called "equirotal waggons." The body has a floor space, 9 feet 4 inches long by 5 feet 3 inches wide, and rests upon the axletrees by semi-elliptical springs, with a check-spring under the centre of the waggon.

The wooden sides are about 20 inches high, and from them run up from sockets three iron standards on either side, supporting an angular framework of ash hinged along the centre, forming the waggon roof, which, with the sides, is covered by white canvas, dropping as curtains over the waggon, and forming also a hood to protect the driver and patients in front, and curtains to shield those sitting behind. A canvas curtain also closes the front of the waggon behind the driver's seat, preventing wind and rain entering the waggon from that end. The interior of the waggon is divided longitudinally by a partition 14 inches high, which separates the floor into two equal portions, and these portions are occupied by two stretchers of the ordinary "Faris" pattern, which are run in on their wheels into the waggon. Besides these lying-down arrangements for two patients, three individuals, viz. the driver and two patients, can sit on the front driving seat; and three more, two patients and an orderly, can sit on a hind seat on a level with the floor of the carriage, with their legs hanging out, and protected by a tail-board and leather apron. A sliding partition of wood is placed across the waggon near the rear, acting as a backboard for those sitting on the hind seat. Both seats have leather-covered cushions. Water is carried in a tank (9 gallons) under the body of the waggon, and there is also a corn locker at the rear of the floor of the waggon. A ladder, for use of the patients entering the vehicle, is carried along the sides of the waggon. There are two lockers, one on either side of the sides of the waggon in front, one being used for restoratives, and the other for tools, &c. A double-screw brake worked by a cranked lever handle acts on the hind wheels; a drag shoe is also carried.

The rifles and kits of the sick are placed on the floor of the waggon. The waggon weighs about $17\frac{3}{4}$ cwt., empty, and with eight persons and their kits, 30 cwt., and costs at the Royal Arsenal £186.

For shipment, the vehicle takes completely to pieces, the iron supports, and the roof come off, and the wooden sides are likewise collapsible. The wheels are taken off and the tail-board, and the whole can be packed into a ship-space of about $3\frac{1}{4}$ tons. The waggon is usually drawn by two horses, and can either be driven, by pole or shafts, from the seat in single or double harness, or by a postillion riding one of the horses.

The existing new-pattern waggon which we have just briefly described, also differs from the old-pattern waggon by not having a special "waggon-stretcher." The waggon-stretcher was a special article to which the wounded were transferred from the field-stretcher, and then run into the waggon. Surgeon-Major Faris having adapted wheels to the field-stretcher, it is alone used, and runs in along the waggon-floor without the patient being shifted in any way. Spare field-stretchers to the number of four are carried in each sick-transport waggon, rolled up, and suspended by straps from the iron standards on either side.

This waggon cannot be regarded as final of its kind, and we shall refer to its interior arrangement and the system of carrying its patients in due course, but it is in every way a great improvement on the original patterns of waggons introduced after the Crimean campaign.

It must always be remembered that all military carriages in the English service are built by the same department that construct the gun-carriages of the Artillery.

As a result of this system, our ambulance sick-transport carriages are heavier and more weightily constructed than is needed. No doubt the officials charged with their construction can produce many examples of broken vehicles which have given way before the shocks of field service. But it is to be remembered that if one sees carriages constructed on artillery lines, the tendency is to

use them in the rough artillery fashion, and to so load them, and so drive them, as if they were horse artillery gun-carriages taking a "bee line" across country. This very rudely strong construction then probably defeats its own end, and lighter carriages, built like the tradesmen vans we see so largely used in business work, would probably never be so heavily loaded, nor would the drivers attempt to thoughtlessly cross country with them.

If one had the power, one would like to withdraw all ambulance-carriage construction from the Gun-carriage Factory, and place it in the hands of civil coach-builders, explaining to them what was needed for us, and offering a prize for the most suitable article.

It is absurd to think that the mere fact of having to take a vehicle to pieces for shipment should necessarily handicap its construction. Such needs could easily be met by civil coach-builders, and no doubt many new combinations would be seen.

The National Aid Society, with its blank cheque on the wealth and philanthropy of the public, might well offer a prize for such a vehicle.

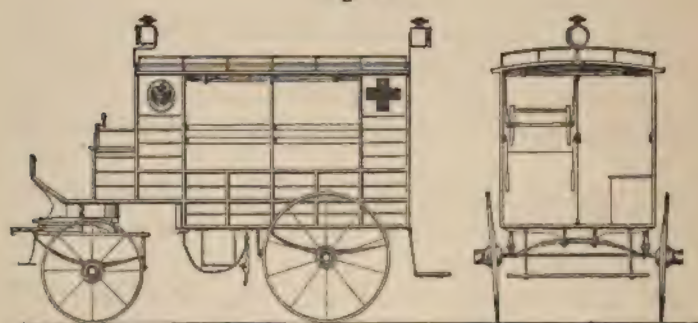
We must point out then in criticising our military sick-transport waggon, that, with all its huge space, practically only two seriously wounded men can be carried lying down, and that four more slightly wounded are carried, two in front, and two in the hind seat of the carriage. Can we consider this as a perfect waggon? Can we consider that a seat with the driver on a wet or snowy day or night is a suitable place for a wounded or sickly man?

The verdict would frankly be no. Nor can we consider the hind seat, with its apron and tailboard, a very desirable place for delicate men in bad weather, apart from its back-board blocking up the thoroughfare or free entrance for the attendants into the sick men lying within. In point of fact, the two patients with the driver would be frozen with the cold, and the patients behind completely stop the way to allow the orderlies to feed or supervise the serious cases within.

These defects have then to be dealt with, and they point to the absolute need of arrangement for four lying-down patients, or two lying-down patients, with four others sitting in omnibus fashion, well protected within the vehicle. This arrangement would leave the driver's two seats available for carrying the nursing orderlies of the hospital, and also the hind seats for the same purpose.

It is absolutely essential to remember that if we make our nursing orderlies march, without any carriage being given them, they become so wearied as to be unfit for work on arrival in camp—the very time when doctors' and

Fig. 28.



SICK-TRANSPORT WAGGON OF THE AUSTRIAN RED CROSS SOCIETY, VIENNA, BY LOHNER & CO., VIENNA.—CARRYING FOUR PATIENTS LYING DOWN, OR TWO LYING DOWN AND FOUR SITTING OMNIBUS FASHION.

orderlies' work begins. Of course, the seats we speak of would always be available for sick or wounded in great emergencies, but for routine purposes the interior of the waggon should be ample and sufficient.

Let us first glance at the construction of some foreign waggons.

The sick-transport waggon of the Austrian Red Cross Society, built by Lohner & Co. of Vienna, seems a very lightly built yet strong vehicle. Its whole construction is more after the fashion of the hickory and steel combinations of America than of our artillery-waggon-like structures. At the Berlin Exhibition the waggons built by this well-

known Viennese firm seemed to be the lightest in construction of any present, although practically all Europe was represented, England excepted.

Any who desire to see the various designs of ambulance vehicles made by this house should write to Lohner & Co., Hofwagenbrik, Vienna, Austria. Price of this sick-transport waggon, 850 florins; cost of packing for London, 40 florins; transit cost, viâ Hamburg, 200 florins.

We are not able to give absolute data of weight of this waggon, but the whole impression given was one of extreme lightness. It does not take to pieces for embarkation, as that is not a factor in Continental waggons; but it is probable that this packing-up difficulty is a mere bugbear, as any coach-builder should be able to simplify his construction so as to let the structure be easily taken to pieces and set up. The whole of the woodwork seems very light, the heavy hind seat and tailboard is absent, and the whole style is like a private omnibus rather than an ammunition waggon.

Four stretchers for seriously wounded cases can be carried, loaded with patients; but if this is done, the entire interior of the waggon is filled. These four are carried in this way: two suspended above, and two below on either side of the waggon.

The mode of running in the stretcher, always difficult with us, is simple.

Halfway up the sides of the waggon runs a narrow iron rail or tramway, about a quarter of an inch wide; a similar tramway is supported down the centre of the waggon by a central standard of iron. On this tramway on either side runs four tiny wheels, which run easily on the narrow rails. From these four wheels hang four leather loops.

When a patient comes on the stretcher, the four wheels and their dependent loops are drawn to the rear of the waggon, and the handles of the stretcher slipped into the pair of loops belonging to the right or left side, and the little wheels are then run down the tramway, and the stretcher dependent from them glides into its place, the

rear handles being fitted into the rear loops. This method is repeated on either side, and at the top of the sides is a similar tramway which takes the two upper stretchers, thus holding four in the interior. If two patients are carried lying down, one above the other on one side, the opposite side can be used like an omnibus seat for four or more patients, sitting in an ordinary omnibus fashion—a most important arrangement; sheltering them from the weather, and allowing the attendant to pass in, to nurse the serious cases if needs be.

It must also be remembered that in war and in peace many men are not seriously ill, but want suitable conveyance, only seated. Our English waggon constantly has its interior empty if there be no lying-down cases, but owing to the absence of any removable omnibus side-seat system in the interior, the invalids must either sit with the driver, and be exposed to cold and wet, or with the hind-seat attendant, also an uncomfortable position.

The Rucker plan of interior arrangement of a sick-transport waggon is very interesting. It was favourably reported upon by the United States Army Medical authorities. Four patients can be carried lying down, or eight or ten sitting in omnibus fashion. No. 1 (Fig. 29) shows the carriage arranged as an omnibus for eight or ten men, the seats being along the sides of the waggon. In No. 2 the seats have been lowered to the floor of the waggon, ready for two seriously ill cases, and the backs of the seats have been raised to a horizontal position to receive the two stretchers carried previously suspended from the roof.

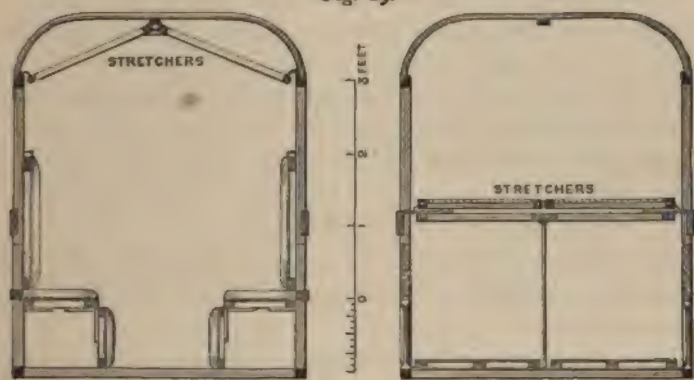
Both these systems seem to be rational and common-sense. A waggon carrying only two serious cases is not the best for the great demands of war, and the alternative omnibus system of side seats is absolutely essential for peace work, and for the sick convoys which in war time contain many convalescent men who, while not needing lying-down space, could not sit on a coach-box in bad weather.

It will be seen, then, the lines on which change might be made in our waggon.

First of all, a definite removable omnibus side-seat system, either of the Rucker or Lohner type, is as essential as it is easily done. It will be a great boon to the soldier.

Second: while maintaining, as at present, the two-wheeled stretchers on the floor of the waggon, a tramway of iron might be fastened to the existing iron standards, and a

Fig. 29.



CROSS SECTION OF THE RUCKER WAGGON.

No. 1, arranged for patients sitting. No. 2, arranged for patients lying down; the seats being detached, lowered, and acting as stretchers. The back of the seats being raised, and supporting two stretchers brought down from the roof.

central standard erected in the waggon. Along this tramway small wheels with dependent loops, after the Lohner system (Austrian Red Cross), might be placed so as to run in two upper stretchers, making a total of four lying-down patients' spaces.

In everyday work we would find that two stretchers on one side would be used, and the omnibus side-seat on the other side would be simultaneously utilised. Few will deny that so simple a change will be fraught with comfort to the sick. The seats with the driver and the

hind seat can then be utilised, if needed, for the nursing staff, for which they alone are suited.

It should not be impossible to devise a sick transport-waggon, which, when not in use, could be completely dismantled; its seats being utilised in the field-hospital tents as seats or benches; its sides as tables, its cover as a *tent d'abri* for the driver, its pole for a flagstaff, and its water-tank as a water-tank. In this way the exposure to the sun and the rain, which in war time injures greatly all vehicles, might be minimised, and the sick benefited by the extra comfort derived from the tables and seats, so needful, and yet so ever absent in war. English ingenuity has, as yet, made no step whatever in the direction of ambulance-equipment development; but as the people get more taught about the subject, development must come.

Should not our medicine-waggons take bodily to pieces, and go in under cover as part and parcel of the dispensary-tent, making up into tables and benches?

Should not our equipment-waggons themselves likewise furnish extra comforts to the sick, as tables and articles of furniture?

Should not every hospital-waggon of every kind carry with it its share of the hospital staff. The storekeeper seated on the store-waggon, the dispensers on the medicine-waggon, the watermen on the water-cart, and with the bearer company, should not the omnibus arrangement of the interior of the sick-transport waggon be in war time, and in the urgent need of rapid advance, utilised as a means of carrying the ambulance-bearers themselves to the scene of action? Just as a horse-artillery battery can move more quickly than a garrison battery, so should a bearer company be able to move rapidly to the field of action. This is certain to be one day the rule.

It is thus that gradually the noble dreams of Larrey and Percy, and the wishes and aspirations of those hopeful English army surgeons who lived in the far-away past, will one day be realised.

The one way, the only way, to achieve it is to tell the

nation our wants, and to teach the people how to be humane. That good work once done, all the rest will assuredly follow.

Civil Ambulance Sick-Transport Waggons.

For civil ambulance sick-transport waggons, such as would be needed for municipal or rural work, the requirements are different from what is essential for military work. In the first place, the carriages need not take to pieces for embarkation, a difference affecting the character of the structure.

Secondly, the carriage can be made with a crank-axle, that is, one which sinks much lower than the height of the centre of the wheel, enabling the waggon-body to ride at a level near the ground; this is seen in Dr. Howard's ambulance transport-waggon.

Thirdly, the whole of the fittings can be of a more luxurious character in civil conveyances, and lightness can be carried to a very marked degree.

Howard Ambulance Sick-Transport Waggon.

Dr. Howard's sick-transport waggons are now fairly well known to the public. They are the waggons used by the London Ambulance Service, and are to be found at the Fulham, Stoke Newington, and Lambeth Police Stations, as before mentioned.

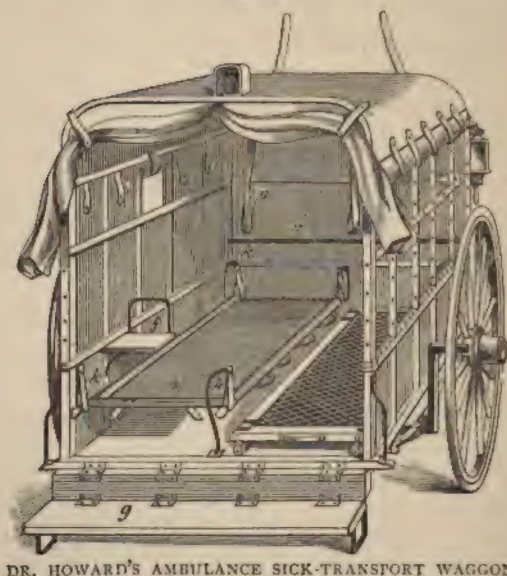
It is practically a little apartment on wheels, 6 feet 6 inches by 4 feet 1 inch, in which on a sliding litter a patent can lie, with an attendant seated beside him. The vehicle can be placed on a railway truck or steamer without difficulty. It is drawn by one horse, and is very light, owing to the crank-axle the floor of the waggon is within 15 inches of the ground, and the tail-board drops down to form a step halfway between the distances. The hind wheel is large, and is in the centre of the vehicle. The floor is below the centre of motion, and the spring from which the body of the carriage is suspended is a very long semi-

ellipse. The four wheels have rubber tires. The entire carriage turns on its own axis. Beneath the driver's seat

Fig. 30.

DR. HOWARD'S AMBULANCE SICK-TRANSPORT WAGGON. (External view.)

Fig. 31.

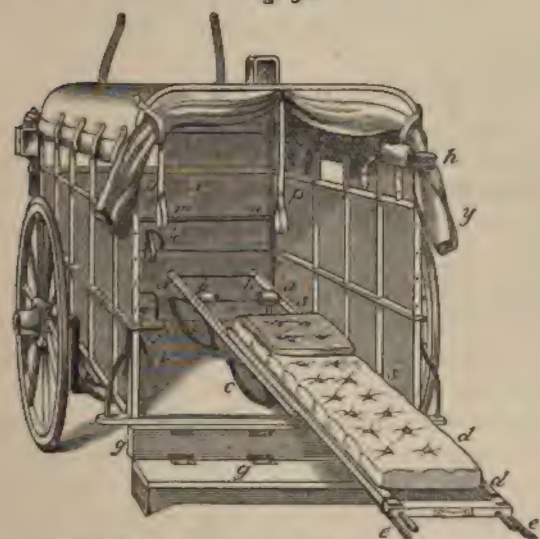


DR. HOWARD'S AMBULANCE SICK-TRANSPORT WAGGON.

is a box for surgical appliances, and there is an opening to it from the interior of the carriage. Shafts and poles are

supplied, and either one or two horses may be utilised. In the interior the right half of the floor is occupied by a light tramway, with india-rubber roller tires. The tramway rests on four elliptical springs, the pair at the head being 6 inches higher than those at the foot. Between the side of the tramway and the side of the vehicle are india-rubber buffers. Resting upon the india-rubber rollers is a light

Fig. 32.



DR. HOWARD'S AMBULANCE SICK-TRANSPORT WAGGON.

(*a a.*) Tramway. (*b b.*) Rubber rollers. (*c c.*) Counterpoise springs. (*d. d.*) Litter. (*e e.*) Sliding handles. (*f.*) Attendant's seat. (*g g.*) Tailboard. (*h.*) Folding stretcher. (*k.*) Suspension loops. (*m.*) Supporting bar for police stretcher. (*pp.*) Patient's aid straps. (*s s.*) Lateral buffers.

cane-bottomed litter with sliding handles. Upon the litter is a thin hair-mattress and pillow.

The front litter-bearer walks into the carriage, and rests the litter on the rear roller, the rear bearer then pushes in the litter into position. A suspended strap is for the patient to lift himself up if desired, and a corresponding strap at the lower end may support a fractured limb.

The other half of the interior has in it a seat for the attendant, and is otherwise clear at ordinary times; but if a second patient needs to be carried, a stretcher is kept in the roof of the carriage, and can be lowered and suspended by loops hung from iron supports in the floor, and lies at the same level as the left-side litter.

If four patients have to be carried, two other stretchers are needed, and these rest with their front handles on an iron bar, running across the back of the front of the carriage, and the rear handles rest on the iron-bound top of the tail-board.

For ventilation and lighting, openings covered by canvas curtains exist, and doubtless for our climate some of the openings should be covered in by light wooden shutters.

If desired, the carriage can be cleared out of all its contents, and will remain available for any ordinary carrying purposes.

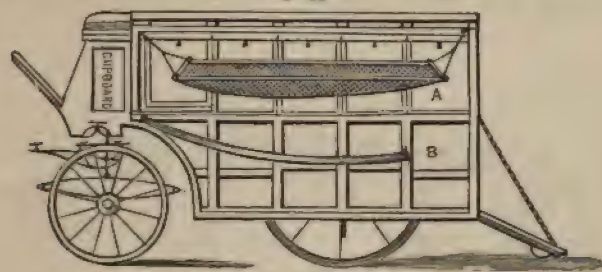
The price of this carriage is about £60, and it is made by the Alexandra Carriage Works, 12, Long Acre, London, W.C., from whom no doubt plates and price-lists could be obtained by any persons enquiring on this subject. A much smaller size of this waggon is made, to hold a single patient, without room for any attendant, and to be drawn by a man, or by a donkey or pony. It seems to me to be very useful for village work, and the vicar of Stepney, who has one for use in his parish, writes favourably of it. Its price is £40, from the same makers: with shafts the cost is £45.

Both these classes of waggons may be supplied to suitable districts in the London Metropolitan district by the London Ambulance Service as a philanthropic work, and applications for further information should be addressed to the Honorary Secretary of that Service, A. H. Haggard, Esq., London Hospital, Mile End, London, E.

Davy's Ambulance Sick-Transport Waggon.

Mr. Davy, one of the surgeons of the Westminster Hospital, London, has constructed an ambulance transport carriage, in which he utilises slung hammocks or suspended

Fig. 33.



DAVY'S AMBULANCE WAGGON.

cots. The waggon can be ran on to a railway truck, and the patient, without leaving the original conveyance, is taken to his destination.

Furley Ambulance Sick-Transport Waggon.

This is a one-horse ambulance carriage of varnished wood, with English oak wheels and sliding windows. It carries three patients; two on stretchers on the floor, and a third suspended from roof, and two attendants. The driver's seat is hooded, and there is room for the two attendants on the box. The third stretcher is suspended by a hook from a little trolly with four wheels, which runs along two wooden rails (*f*) fixed to the roof of the vehicle. The handles of the stretcher are placed in the loops, and the trolly runs down to the far end of the carriage, the rear end of the stretcher resting on a padded bar (*b*) which juts out from the side of the vehicle, and can, if not needed for use, be detached at pleasure.

Mr. Furley has also devised a system by which any private omnibus or such-like conveyance can be converted

pro tem. into an ambulance transport-waggon. This is done by the same trolly system running along the roof of the carriage, and with loops suspended from it.

The handles of the stretcher are placed in the loops, and the trolly slides along the tramway, and runs the stretcher home into the carriage; the rear handles are then rested on a padded bar, which can be removed when not needed.

Fig. 34.

THE FURLEY AMBULANCE WAGGON.

This system of a convertible omnibus ambulance is very useful, as there are many country houses which have omnibuses, but which only once in a way need to use them as ambulance transport-waggons. This interchangeable system of Mr. Furley may be considered to fill up a distinct want in everyday life. Further particulars as to Mr. Furley's waggon could be learnt by addressing that gentleman at St. John's Gate, Clerkenwell, E.C.

The Atkinson-Philipson Sick-Transport Waggons.

Messrs. Atkinson and Philipson, 27, Pilgrim Street, Newcastle-on-Tyne, have devoted considerable attention to ambulance construction for accident cases and for infectious disease. They are able to supply a very comfortable and well-finished sick-transport waggon for from £65 to £75, and have also cheaper patterns as low as £45 to £50.

Their best pattern waggon carries two patients lying down—one resting on the floor of the waggon, and one suspended above it on the same side by hooks from the roof, and on the opposite side is room for one sitting patient and two attendants. An attendant can also sit with the driver in front of the waggon.

The waggon has four wheels, the two in front being lock-under, and having crank axles the body of the carriage rides conveniently low. The firm forward plates and prices of waggons to all applicants.

Ambulance Transport Waggons for Infectious Disease.

These ambulance waggons should not vary externally in any marked degree from ordinary accident-waggons. What is needed for them is extreme simplicity of internal arrangement, every possible means of harbouring infection being removed. Every portion of the carriage interior should be removable, and the litter or stretcher should have a wicker or canework bottom. All iron-work should be galvanised, as the disinfectants used destroy the ordinary paint, and rust the unprotected iron.

Some waggons are lined throughout with sheet zinc, unpainted.

To save the labour of attendants, and to secure complete disinfection, a small hand pump which forces the disinfecting fluid into every part of the carriage is useful; it saves the labour of mopping out the interior.

The need of ample ventilation in such conveyances is

self-evident, especially for the sake of the nurse or attendant seated in the carriage.

For communication between the driver and the attendant, a speaking-tube is not desirable; but a dial, with faces on the outside for the driver, and on the inside for the nurse, with an index pointing to the words, "Stop"—"Go on"—"Drive gently"—is useful. There should be no special compartments for medicines or restoratives in such carriages, as these nooks harbour disease, and cannot be easily disinfected. A basket containing all needful medicines or dressing articles should be taken by the attendant in his own hands into the waggon. The blankets used for keeping patients warm should of course be at once disinfected after each case.

On the rigorous precautions as to the clothes of attendants there is no need to dwell here.

The Alexandra Carriage Factory, at No. 12, Long Acre, manufacture infectious-disease ambulances for the Metropolitan Asylums Board, at a cost of 72 guineas each.

The same firm make an infectious-disease ambulance on Dr. Howard's principle at a cost of 90 guineas. The firm issue engraved pictures of their infectious-disease sick-transport waggons. Some singularly neat-looking infectious-disease ambulance conveyances are made by Lohner of Vienna—the well-known carriage-builder—and those interested should write to him for his pictures of the conveyance. Lohner & Co., Hofwagenfabrik, Vienna.

CHAPTER XI.

RAILWAY AMBULANCE AND SICK-TRANSPORT SYSTEMS.

Crimean Railway carriage of Sick—The younger Baron Larrey's work—Dr. Gurlt's efforts—The American Railway Sick-transport systems—Description of Baron Mundy's organization of the Austrian Maltese Knights Order's Ambulance Trains—Descriptions of the various carriages in it—Extemporised use of Railway Carriages for Sick-transport—Zavodovsky's system—Grund's system—Beaufort's system—The Hamburg system—Civil Railway transport systems.

THE important part played by railways in modern war has reacted to the very fullest extent on the medical services of the various European armies. The removal of the sick and wounded to the base of operations, or to far-removed hospitals in their own countries, is now as recognised a part of a great war system as the use of the railway in mobilisation is a factor in military administration.

We find that from the first development of railways, some forty-five years ago, no war on a large scale took place on the European mainland giving an opportunity of trying the use of railways for the removal of wounded until our own times.

In the Crimean campaign, the railway built from Balaclava towards the front was used in a haphazard way to carry wounded and sick, but without any *matériel* suited for the purpose.

In 1857, the younger Baron Larrey made some experiments at the Camp at Chalons in this direction, and some rude contrivances were adopted for use in carrying sick men to the general hospitals.

In 1860, Dr. Gurlt of the Prussian service devised a

system of hammocks slung from the roof of carriages for conveying the sick.

But for the true era which marks the fuller development of the railway idea in removing sick and wounded in war time, we must look across the Atlantic, and we find that in the great war of the Rebellion in the United States these ideas were very fully carried out.

The United States had everything in its favour for achieving success. When a nation has the common sense to devise a system by which everyday travellers can pass from carriage to carriage in a train; by which in warm weather they can, as they need it, utilise iced drinks, and bathe and wash themselves; by which in winter the carriages can be warmed to any needed temperature by a stove common to a large carriage, and by a system which enables latrine accommodation to be available while actually *en route*, it does not need any very brilliant intellect to devise a very perfect hospital train. The American cars opening from end to end longitudinally, and all united to each other by a kind of drawbridge, are at once ready for sick, if only lying-down accommodation is devised for patients.

The Americans placed a certain number of upright posts along the central gangway or passage of the carriages, and on these uprights and against the sides of the carriages they hung strong india-rubber rings, into which the handles of the stretcher were thrust, and such stretchers placed in two tiers, one above the other, on either side of the central gangway, turned the carriage at once into an hospital waggon. Water was already provided, latrine-accommodation already existed, the stove was always there, and with these essentials arranged for, the wants unattended to are not many.

With such trains as these the Northern medical authorities carried back from the front, by the thousand, sick and wounded soldiers; and a great departure for good, and a distinct minimising of human misery may date from that era. There is really not much to say about the American

system, it is so self-evident, so common-sense, that it explains itself.

Ventilation of course must be very fully provided for, probably by roof ventilation, or by windows left open in the carriage. Add a cooking waggon, and a dispensary waggon and a store waggon, with a sleeping-car for the medical staff, and in such a train you can carry wounded wherever rails are laid.

In Europe, of course, all this is different. We still cling to the old coach system of separated compartments in our railways, and to say nothing of being murdered now and then, we get baked in summer, frozen in winter, and suffer much inconvenience in long journeys from want of suitable latrine arrangements in a truly Old World spirit.

Railway ambulance systems in Europe are practically of two kinds. One is the definite *train* system on the American plan, where the carriages are made to open at either end, and a free thoroughfare exists from the engine in front to the guard's-van behind. As the most perfect development of this *train*-type of ambulance-railway transport, we will glance at the elaborate trains of the Sovereign Order of the Bohemian (Austrian) Branch of Knights of Malta.

The other system may be termed the *carriage* system of ambulance-transport, where there is no central gangway through the train; but owing to various reasons, mainly the absence of end-communications, each carriage has to be dealt with independently, and as a separate unit.

All who desire to study from an exhaustive, complete, and elaborately detailed source the construction and equipment of ambulance trains, should obtain the official volume issued by the Austrian Branch of the Sovereign Order of the Knights of Malta, called "Freiwilliger Sanitats-Dienst im Kriege," printed by L. W. Seidel and Son of Vienna for the Order. This most noble volume, which is entirely the outcome of the energy and self-sacrifice of Baron Mundy, the greatest living authority on ambulance organization, is so complete in detail, that, placed in the

hands of any railway carriage-builder, an ambulance train of singularly perfect character could be made up without one further word of explanation.

These trains now to be described are constructed and maintained at the cost of the Austrian (Bohemian) Branch of the Knights of Malta, an Order which still retains its estates of which the Order in most other countries has been deprived. Each train consists of 18 vehicles of every kind, and communication is open throughout. As it stands upon the railway line it would be marshalled as follows:—

1. Engine and tender, ordinary pattern.

2. Guard's-van with railway guard, ordinary pattern.

3. Carriage of special construction for the sleeping-places of the Knight representative of the Order and the medical officers.

4. Store waggon for carrying the wines and various eatables for use of the sick. Special construction.

5. Kitchen waggon of special construction, with all the culinary utensils and equipment needed by the cooks.

6. A refectory waggon—or dining-waggon—where the staff of the train and the convalescent patients who are able to move about can sit at regular tables, and have their food in comfort away from the sick carriages.

7, 8, 9, 10, 11, are five ambulance sick-transport carriages, each carrying ten patients lying down, on stretchers suspended along the sides of the carriages.

12. A magazine waggon containing the linen store, and the dispensary or pharmacy, containing all the medicaments, instruments, and technical equipment needed by the medical officers.

13, 14, 15, 16, 17. Five more ambulance sick-transport carriages, each containing ten patients.

18. The guard's-van of the guard conducting the train.

We thus see that 100 patients can be carried lying down in the carriages, and that the train is absolutely self-contained, and is completely a unit in a military sense.

We may briefly notice the individual carriages.

The Medical Officers' Carriage does not need a special

picture. It is divided into distinct cabins for each medical officer. It has a lavatory, latrine, and in each cabin a couch, mirror, washhand-basin, drinking-vessels, &c., for the occupant. You must make your staff comfortable if they are to live in the train, and this Baron Mundy has done. It is absolutely essential to secure good work from good men. This carriage is joined by a movable bridge, over the coupling-irons of the train, with the *Store Waggon*, in which are contained in presses or cabinets along the sides the wines, the preserved stores, the biscuits, and the various food-supplies of the train. On the floor of the carriage are a series of ice-boxes for ice, and store-boxes for bread, meat and vegetables. This carriage does not need any special picture, as any intelligent carriage-builder would at once understand what was needed.

It practically amounts to a number of store-cupboards along the sides of the waggon, and ice-boxes and meat-safes below them. In the corner of the carriage is a screened-off compartment for an official. We then pass on to the

Kitchen or Cooking Waggon.—(Figs. 35, 36.) This is a special waggon, and we give here a section of the carriage and a plan of its construction. How completely essential good cooking is to the sick and wounded, medical men of all others recognize, and this waggon is very complete, enabling good work to be done.

On either side of the central gangway stand the cooking-stoves, warm-water holders, the water cisterns, the chopping-blocks, and the various cupboards to contain the articles needed by the cooks.

Along the sides are hung with order the culinary implements for cutting, chopping, &c., the meat, and the saucepans are placed on the shelves. We have made such progress of late in England in stove building and kitchener arrangements, that, given a suitable carriage, any leading manufacturer ought soon to fit out the cooking-waggon. Next to the kitchen waggon comes the *Refectory or Dining-room Carriage*, which needs no special description. It has the

usual passage down the centre, and six tables with benches placed along the sides of the carriage. A sideboard with shelves above holds the various plates, tumblers, and table requisites needed by the train staff, and these are arranged somewhat like a ship steward's pantry or washup room. In fact, a ship's dining-saloon would be a capital model for equipping this carriage. There is a small bath-

Fig. 35.

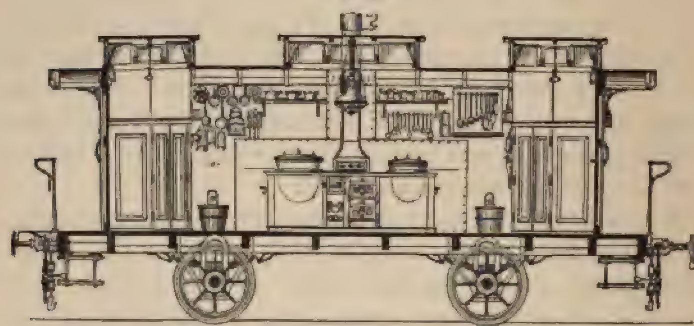
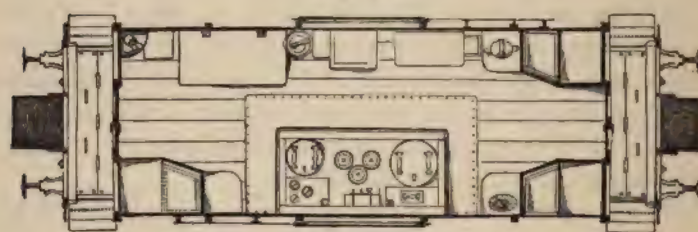


Fig. 36.



RAILWAY KITCHEN WAGGON OF THE AUSTRIAN AMBULANCE TRAINS OF THE KNIGHTS OF MALTA, AUSTRIAN BRANCH.

Upper plate—section ; lower plate—plan.

room for a douche bath, screened off from this carriage. How important it is to have the dining-room specially told off and separate, and to prevent eating in the sick carriages as far as possible, all medical men will agree.

The five sick-transport waggons now are come to, and we have here a plate showing their arrangement. (Figs. 37, 38.)

Each carriage holds ten patients lying down, the space

for two patients being occupied by the stove, lavatory, and latrine, with which each carriage is fitted. These occupy the middle compartment on one side, reducing the accommodation by two lying-down spaces.

The arrangement of the stretchers is very simple; they are placed in an upper and a lower tier on either side of the gangway, six on one side, and four on the other.

Fig. 37.

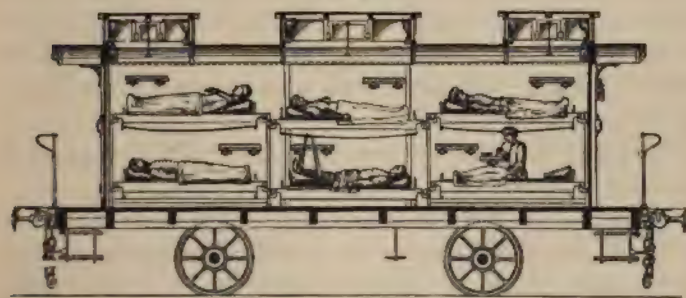
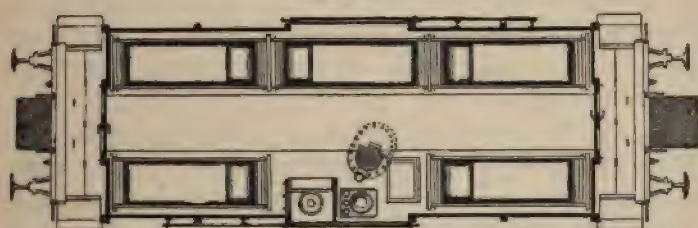


Fig 38.



SICK-TRANSPORT WAGGON OF THE AUSTRIAN BRANCH OF THE KNIGHTS OF MALTA.—FOR TEN PATIENTS LYING DOWN.

Above—the section; below—the plan.

Special iron standards are screwed into the floor of the carriage, and also fastened to the sides of the carriage, and these may be readily compared to the iron standards of our barrack-room tables, or somewhat like a small bed-room towel-horse. On these standards the stretchers are laid in two tiers, one above the other. The whole thing is most simple and easily understood. Ropes for the patients to help themselves up by are hung over each cot, and there

is a shelf to hold bottles, drinking-vessels, &c., screwed on to the walls of the carriage.

Ventilation of an elaborate character is arranged for by opening in the roof. The provision of a lavatory, latrine and stove in each carriage we have noted already.

Electric, and we presume telephonic communication, or speaking-tubes, unite the carriages, and keep touch between each portion of the staff of the train.

Five such carriages are placed consecutively on either side of the magazine waggon. This contains the linen store of the train, and all the needful changes of under-clothing for the sick. It also contains spare mattresses, pillows, stretchers, &c.

The Pharmacy or Dispensary portion of the waggon is easily described.

It is like a very first-class ship's dispensary placed on wheels. In it are the medicaments, instruments, medical documents, &c., for the medical staff, and a couch for the dispenser. Any naval architect would fit up such a carriage for a dispensary in a day or two. In fact, both in the dining-room, kitchen and dispensary we could learn much from ship's arrangements. A bath is also fitted up in the magazine waggon.

In the book before mentioned "Freiwilliger Sanitats-Dienst im Kriege," issued by the Malleser Ritter-Orders, will be found every detail of construction of these trains, so clearly drawn as to enable any ordinary constructor to act at once upon them.

The trains are kept ready at all times by the Maltese Knights for the Austrian War Office, and a definite agreement exists defining the duties of the Order, and the rights of the Government.

In the various European countries trains of this description, more or less elaborate, either exist, or the *matériel* needed for their instalment is ready to hand in the store-houses of the Government or the Aid Societies. In Germany the 4th-class railway carriages are now made to open at the end instead of at the sides, and these 4th-

class carriages are converted into ambulance trains on the outbreak of war. When once we understand the main lines which have guided Baron Mundy in the organization of the Austrian trains above described, we can easily grasp the various arrangements of other countries, for they are all based on the same idea.

We now turn to note the arrangements made in countries or places where *train* systems are not possible, owing to the carriage opening at the sides and not at the ends. In all these cases the custom seems to be to utilise the goods waggons of the various railways, and in the clear space these carriages allow, to fit up extempore arrangements for the wounded.

What is mainly needed is some method of breaking the jarring of the railway carriage as it traverses the line, and some method of suspending the wounded on their stretchers in the carriages. We may note four methods of achieving this, viz. :

Zavodovsky's system ;
Grund's system ;
Beaufort's system ; and the
Hamburg system.

There are also many others.

Zavodovsky's System consists of fastening a cable (Fig. 39, A. A.) into hooks (*a a*) screwed on to the top of the sides of the carriage. To this cable a pole is fastened by ropes, from which pole hang down ropes (*c c c c*) with loops, in which the handles of the stretchers are placed in two tiers, one above the other.

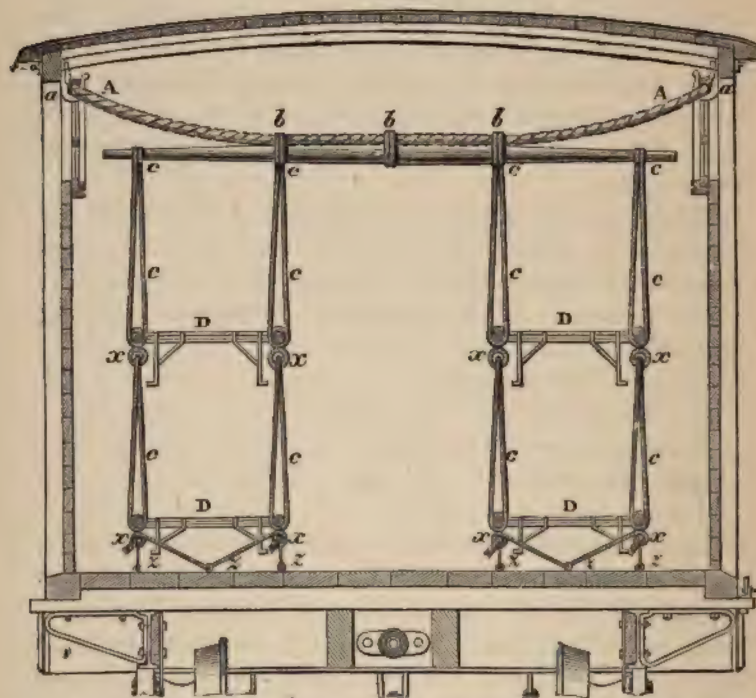
The lower tier of stretchers are fastened by ropes to the floor of the waggon, to prevent the swaying motion induced by the carriage in its progress.

This system is useful when a number of luggage waggons have to be rapidly converted into ambulance waggons. A single waggon will thus hold eight patients lying down ; four on either side of the door of the waggon.

Grund's System (Fig. 40) of converting goods waggon for use of sick or wounded consists in placing two spring supports

on the floor of the waggon. A pole is fastened from one spring to the other, generally sufficient in width to rest three stretchers. On this pole, supported by the springs, the heads of the stretchers are rested, and a similar pole on similar springs receives the foot of the stretcher. By this

Fig. 39.



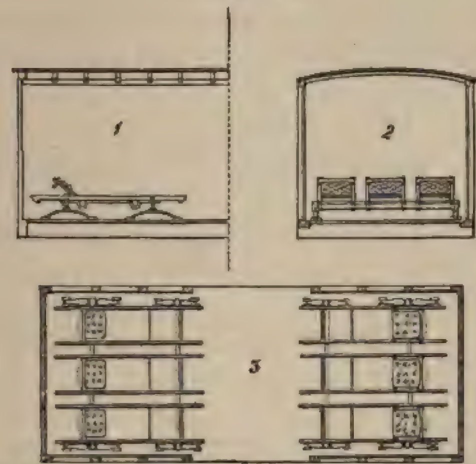
TRANSVERSE SECTION OF GOODS WAGGON, SHOWING ZAVODOVSKY'S METHOD OF SUSPENDING STRETCHERS BY ROPES.
From Surgeon-General Longmore's 'Gunshot Injuries.'

system each goods waggon can hold six lying-down patients.

Count Beaufort's system of converting a luggage waggon for carrying sick is practically the same as *Grund's* system. A portable case, Fig. 41, No. 1—which packs up for transit as in No. 2—receives the stretcher as

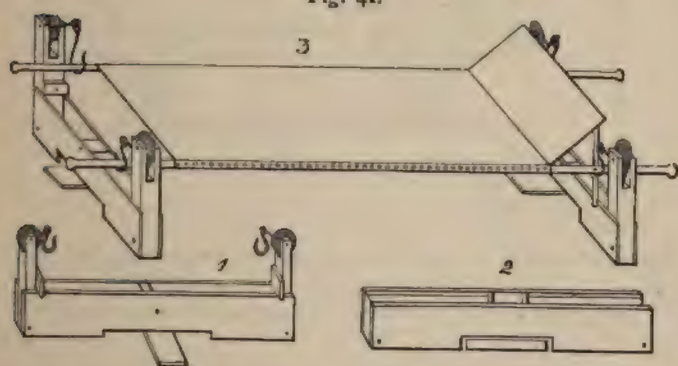
in No. 3—and the springs receive the handles of the stretcher, and thus the shaking of the carriage is counteracted.

Fig. 40.



GRUND'S SYSTEM OF CONVERTING GOODS WAGGONS INTO SICK-TRANSPORT WAGGONS BY A SPRING SUPPORT UNDER THE STRETCHERS.

Fig. 41.

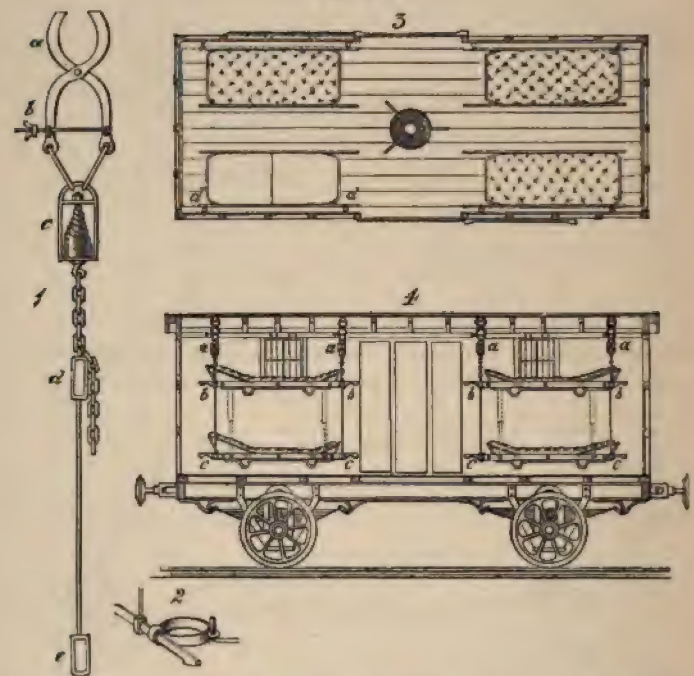


BEAUFORT'S SYSTEM OF STRETCHER-RESTS FOR RAILWAY TRAVELLING.

This system is very portable, and the rests can be made up in any number before a campaign, and can be at once ready for war service.

The Hamburg system of goods waggon conversion seems very simple, and has much to commend it. A spring-suspender (Fig. 42, No. 1) has at its upper extremity a clamp (*a*), with screw (*b*), which can fasten on to the timber of the roof of the carriage, and be screwed there. There is a coiled spring at (*c*) which breaks the force of

Fig. 42



HAMBURG SYSTEM OF STRETCHER SUSPENSION IN A GOODS WAGGON.

No. 1. The spring-suspender, with clamp. No. 2. The side-fastening. No. 3. Plan of carriage. No. 4. Section, with stretchers inside.

the motion of the carriage. Further down, suspended by an iron chain, which can be raised or lowered, is an iron rod with a rectangular holder, into which the stretcher-handle can be slipped.

There is a second stretcher suspended in a similar manner lower down on the same bar.

Four such spring-suspenders will support two stretchers, and the patient travels with much comfort. These suspenders were much commended by some German army surgeons who had tried them, and they certainly are more rapidly adjusted than Zavodovsky's cables.

To prevent swaying during transit, there is a side-fastening which binds the stretcher to the side of the carriage. The complete equipment for eight patients, consisting of 16 clamps, complete with chains, bars and hooks, packed in a chest, can be obtained from the firm of F. G. Dittmann, Wagen-Fabrik, 52 Markus-Strasse, Berlin. Each spring-suspender costs about 17 German marks, or the complete outfit for a carriage for eight patients, minus stretchers, would cost about 300 German marks.

In all these systems of extempore conversion of carriages one will miss the completeness of the Mundy Austrian trains; but war is a time when extempore action is constantly called for, and with the four systems described above, there should be some chance of making a good extemporised ambulance conveyance. There are several other systems of conversion, but they practically group themselves into suspension from the top of the carriage, or rest on the floor of the waggon.

CIVIL RAILWAY SICK-TRANSPORT SYSTEMS.

Very few conveniences are at present available for civil sick-transport by rail. Invalids still travel with difficulty and expense by our railway systems. What is much needed is suitable invalid carriages on our main lines, to be hired at rates within the limits of ordinary incomes.

We very much need in England better arrangements for the many railway accidents we are liable to.

Every guard's-van of every passenger train should have a stretcher compulsorily carried in it, and a basket of bandages and restoratives.

Every railway station should have a stretcher as part of

its equipment. A carrying chair for invalids is also much needed at every station. There should be means of suspending a stretcher in every guard's-van, either by the Hamburg system or other ready method.

To every "break-down train" sent to aid at accidents on railway lines should be attached a regular sick-transport waggon, and the company on whose line the accident occurred should provide suitable conveyance for its victims. In this waggon should be dressings, restoratives, and stretchers for conveying the wounded to the carriage, and to the hospitals afterwards.

The development of sleeping-cars we should watch with interest, as at once on the outbreak of any war we could annex these carriages and convert them into ambulance conveyances. As our great City hospitals develop country branches round London, we may probably find ambulance trains running from London to the outlying hospitals, as a matter of routine daily.

CHAPTER XII.

MARINE AMBULANCE ARRANGEMENTS.

Various Rope Knots used by Sailors in carrying wounded men—The ordinary Navy Cot—The Lowmoor Jacket—MacDonald's Ambulance Lift—MacDonald's Ambulance Lowerer—The Gorgas Ambulance Cot—Ambulance Launches—Ambulance Steamers, 'The Red Cross'—Hospital Ships, 'The Victor Emmanuel.'

WE may here say a very few words about marine ambulance arrangements. Very much progress does not seem to have been made in this direction in naval circles, whether of the Royal or Mercantile Marine.

Inspector-General Macdonald, R.N., is the chief authority to be consulted on this subject; and in his 'Naval Hygiene' the subject will be found fully dealt with.

The existing arrangement for naval ambulance aid may be classified as follows:—

1. Various rope-knots used for carrying wounded men.
2. The ordinary Navy cot.
3. The Lowmoor Jacket.
4. Macdonald's Ambulance Lift.
5. Macdonald's "Ambulance Lowerer" for ship's tops.
6. Gorgas Ambulance Cot.
7. Ambulance Launches—Portsmouth Launch.
8. Ambulance Steamers—'The Red Cross.'
9. Hospital Ships—'The Victor Emmanuel.'

We will briefly deal with these headings.

VARIOUS "SAILORS' KNOTS" USED IN TRANSPORTING, OR LOWERING WOUNDED—

Inspector-General Macdonald states that sailors, with their proverbial handiness in dealing with ropes, contrive

to make very useful knots, with which they can lower or lift helpless men about the ship. These knots are—

The bowline.
The running bowline.
The bowline on the bight.
The clew hitch.
The grummet.

Some of these knots are made round the body of the injured person, and form both a seat and a support in which the patient sits and is lowered.

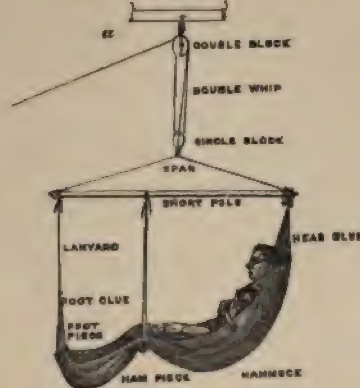
The Ordinary Navy Cot.—This cumbrous article is sometimes used for carrying sick and wounded men. As it is at least 6 feet long by 28 inches wide, the patient rolls about in it; and if it is at all out of the horizontal, the patient slips downwards towards the bottom. As sick men have on board ship to be passed through narrow hatchways, this cot is extremely undesirable.

The Lowmoor Jacket, previously described in the chapter on stretchers, seems to be a useful article for naval ambulance service. It is separate from the stretcher, and hence the army-pattern stretcher could be utilised for naval service if the detached jacket were supplied with it. It is simply a jacket surrounding the chest, with strong back pieces running up behind the patient's back and passing over an iron bar, which is slipped over the handles of the stretcher. Another canvas support passes between the patient's thighs, and still further aids in supporting the weight. A web stirrup can be made for the feet, and this is a great aid also.

Practically, the lowering of a man through a narrow hatchway, or drawing him up a narrow mine-shaft, needs the same, or very similar, appliances.

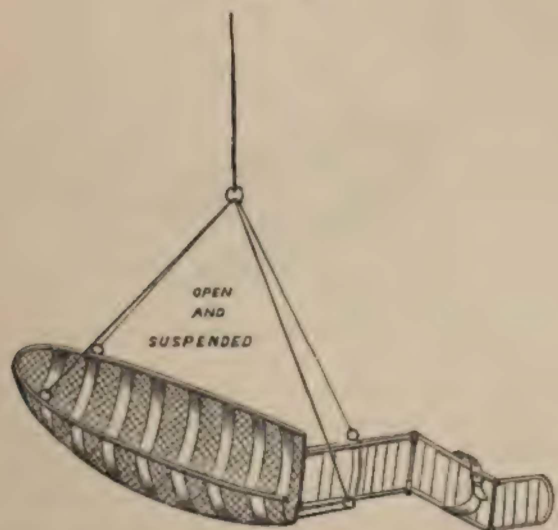
Macdonald's Ambulance Lift.—With the view of remedying the defects of the naval cot or hammock as a means of carrying or lowering patients, Inspector-General Macdonald, R.N., has devised an "ambulance lift." An ordinary

Fig. 43.



MACDONALD'S NAVAL AMBULANCE LIFT.

Fig. 44.



INSPECTOR-GENERAL MACDONALD'S "AMBULANCE LOWERER," FOR USE IN THE "TOPS" OF WAR VESSELS.

hammock is used, the clew and lanyards remaining intact. A short rounded piece of wood, called a "ham pin," is secured transversely beneath the hammock, so as to

correspond with the bend of the patient's knee. Three points of suspension are thus obtained from a short pole, which is hung to a longer pole, or simply connected by a span with the blocks (pulleys) used in lowering the patient.

Macdonald's Ambulance Lowerer. — Inspector-General Macdonald has also devised a lowering apparatus, here depicted, which is kept in the "tops" of a ship, and in it a man can be easily lowered at an angle of about 30°, through a hatchway only 4 feet in diameter.

Fig. 45.

MACDONALD'S AMBULANCE LOWERER, FOLDED UP.

Medical Inspector-General Gorgas's Ambulance Lift.— This cot is the invention of Dr. Gorgas, an officer of the United States Navy. The cot is 5 feet 8 inches long by 21 inches wide, and this small size, with the addition of a breast-band, aids in securing the patient.

The important part, however, is a double inclined plane placed under the buttocks, thighs and knees, and legs, as in the plate. This prevents the patient slipping down in the cot. By the ropes attached, the foot of the cot may be lowered until the position of the patient is almost vertical, and so he can be lowered into the hatchways. It is re-

commended to have canvas loops or beckets on the sides of the frame of the cot, to act as handles for ordinary lifting, and through the same handles poles may be passed, converting the cot into a stretcher.

Ambulance Launches.—For the conveyance of sick from ships lying off a port, to hospitals on shore, or from the shore to hospital ships, as in war time, the arrangements have up to our own days been very imperfect, and no

Fig. 46.

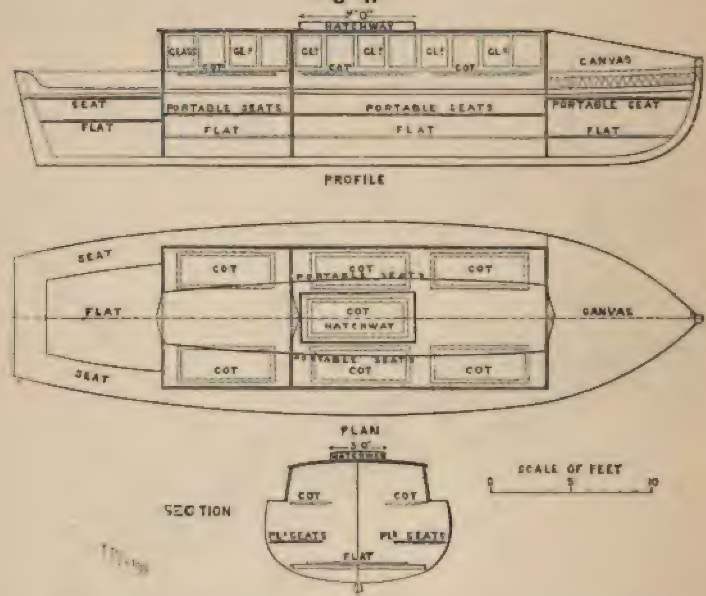
AMBULANCE COT OF DR. GORGAS, UNITED STATES NAVY.

regular arrangements have ever been made to shield the sick from the weather, or to carry them without fear of their injuries being aggravated.

A new departure has now been made in this respect, and through the courtesy of Sir John Watt Reid, the Medical Director-General of the Royal Navy, we are enabled to give a drawing of an ambulance launch just completed at Portsmouth Dockyard. It is to be used in carrying sick and

wounded from the vessels in Portsmouth Harbour to the great Naval Hospital at Haslar. It is an ordinary service pattern launch, 42 feet in length, housed in, and divided into two compartments ; the smaller for four officers lying down, the larger for eight men in the same position. There is also room for others not needing lying-down accommodation. There is a cot-hatchway in the centre of the roof, through

Fig. 47.



AMBULANCE LAUNCH FOR CONVEYING SICK MEN FROM SHIP TO HOSPITAL.

which the sick men lying on their cots, as removed from their ships, can be lowered and placed under shelter on the cot-stands in the cabin. When all the cot-stands are filled, the portable seats can be drawn out, and further utilised for lying-down accommodation.

This valuable boon to the sick will doubtless soon be copied in other large ports, and such a launch will doubtless form part of the equipment of every hospital ship in

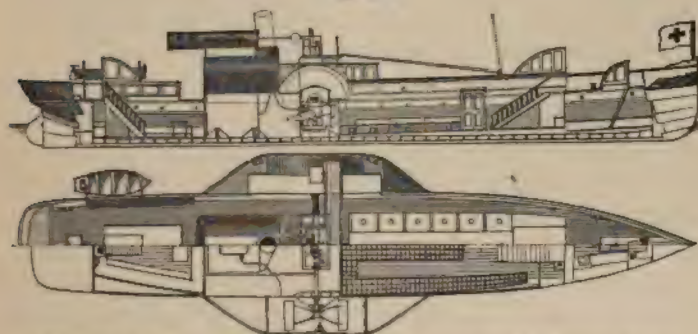
the future. The launch we have been describing has no steam-aid of its own, and requires to be towed by another vessel.

It is well lighted and ventilated, and a stove can be fitted for use in winter time.

AMBULANCE STEAMERS.

There is, as far as we are aware, but one existing specimen of an ambulance steamer devoted solely to the carrying of sick and wounded persons; this is the ambu-

Fig. 48.



AMBULANCE STEAMER "RED CROSS," METROPOLITAN ASYLUM BOARD, LONDON.

lance steamer 'Red Cross,' built for the London Metropolitan Asylums Board, and used for the conveyance of infectious cases of disease from the London receiving wharves to the hospital ships off Dartford.

This paddle-wheel steamer was designed by Mr. Adam Miller, N.A., and built by Edwards and Symes, Cubitt Town, Poplar, E. London. It is 105 feet long, 16 feet wide, and 6 feet 9 in. in depth; the hull is principally of iron, with a strong keel.

It has a silent discharge steam-apparatus to prevent the noise caused by the safety-valves blowing off steam when the engines are at rest.

The vessel is built in six water-tight compartments. An account of the steamer, with large drawing, will be found in the 'Marine Engineer' newspaper of March 1, 1884.

It consists mainly of two portions; one, the fore part, forward of the funnel, devoted to the reception of infectious cases; and the stern portion, which has a saloon or waiting-room for the use of the patients returning cured from the hospital ships.

Forward of the infectious section, but separate from it entirely, is a small room for the crew, and the captain has a cabin near the saloon or stern-end of the vessel.

The infectious disease portion of the steamer, or "hospital," is divided down the centre by a partition into two parts, one for males and one for females—with a doorway between, for the medical staff and nurses.

The lying-down accommodation consists of couches or settees, running continuously round the sides of the hospital, and on these settees the patients lie, covered by blankets, &c. The hospital is reached by a sloping stair from the deck, and is well lit and partially ventilated from the deck by side-lights.

Glancing at this steamer, one is led to ask the question if this down-stairs system of hospital is suitable for an infectious-disease conveyance vessel; and one is forced to think that a deck-house system on the deck level, and freely open to the perflation of air, would be a better plan. The little steamer is for use in the River Thames only, so no great sea-going power is needed, and by deck-house state-room cabins, raised from the level of the deck, the sick would be carried at once into the hospital, and the hospital itself could be very readily ventilated. Doubtless there may be nautical reasons against this proposal, but at first sight it seems a better method of construction.

Hospital Ships.

Type, the 'Victor Emmanuel.' For the transportation of sick and wounded from the seat of war to our own

country, regularly equipped and specially furnished "Hospital-ships" are now requisite. In our old wars, even so lately as the Crimean campaign, the horrors of the middle-passage were extreme, and the condition of some of the so-called hospital ships, used at first to transport sick and wounded men to Scutari from the front, was completely bad.*

It is absolutely essential at the outbreak of a war to have a definite plan ready in the War Office for the equipment of this class of vessels, and that their staff of attendants and interior economy should be completely understood. We have made great progress in this direction of late years, and during the recent Egyptian campaigns the 'Carthage' hospital-ship was of immense use to the army. The outline of the system adopted is to choose a vessel with roomy 'tween-decks. This is done by the Transport Department of the Admiralty; the same officials fit up and equip the vessel, and then hand it over to the War Office for its staff of officials and attendants.

The main-deck is generally converted into the hospital, and cots or portable hanging bedsteads, so arranged as not to swing with the motion of the vessel, are suspended in regular lines on this deck.

A certain portion of the space is usually screened off for sick officers as special accommodation.

The convalescent patients are lodged in a lower or gun-deck, and the hospital attendants are also berthed in the same deck.

The main needs of hospital-ships are a defined nursing staff, so numerous as to afford regular hours of rest for those employed in this fatiguing duty, and to provide fully for the very important night-nursing.

The latrine arrangements also need to be very complete.

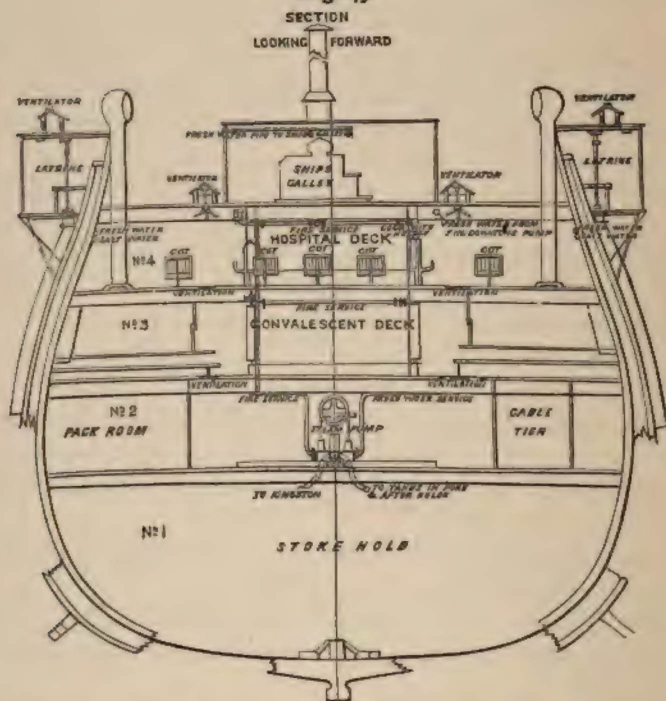
The cooking, as in all hospitals, needs to be carefully provided for, and spacious galleys are always needed.

* Those who desire to read a very complete and interesting account of a hospital-ship, will find Surgeon-Major Bleckley's report on the 'Victor Emmanuel' very useful. A.M.D. Blue-book, 1873.

The laundry is a most essential part of a hospital ship, and on this point Dr. Bleckley's report is very important.

Nothing so degrades the *moral* of sick men as being attacked by vermin; and despite the so-called pomp and glory of war, the almost constant attendants on the soldier

Fig. 49.

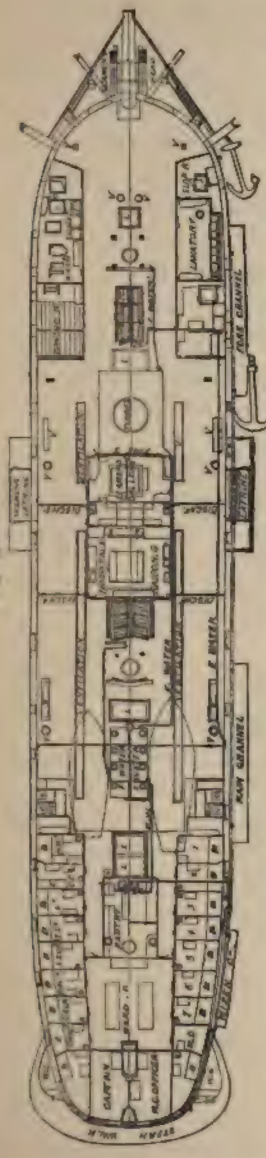


SECTION OF THE 'VICTOR EMMANUEL' HOSPITAL SHIP, SHOWING "HOSPITAL DECK" AND CONVALESCENT DECK.

in the field are vermin. It is only by the very utmost care an army can avoid being lice-infested.

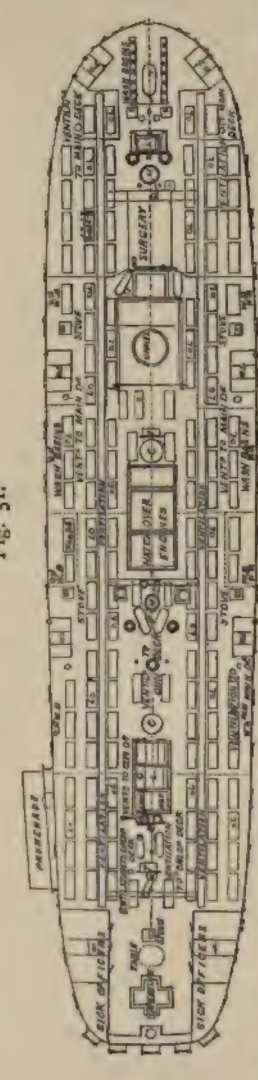
When men fall into bad health, or become helpless in hospitals, the need of keeping them free from lice is paramount. It cannot be done without good laundry arrangements, so as to wash and constantly change the clothes. Every general hospital, every field hospital, and certainly

Fig. 50.



PLAN OF UPPER DECK OF 'VICTOR EMMANUEL' HOSPITAL SHIP, SHOWING PORTION OF THE KITCHENS, LAUNDRY, LAVATORY, MEDICAL OFFICER'S CABINS, AND CABINS OF THE OFFICERS OF THE SHIP.

Fig. 51.



PLAN OF HOSPITAL DECK OF 'VICTOR EMMANUEL' HOSPITAL SHIP, SHOWING GENERAL ARRANGEMENT OF COTS, SURGERY, SICK OFFICERS' QUARTERS, ETC.

every hospital-ship, should have a completely equipped laundry, so that our men may escape this degrading and

disgusting scourge. Ghastly stories are told of the condition of the sick in the earlier days of the Crimean campaign from this odious and loathsome parasite, and the like must never happen again. It can only be avoided by organization beforehand, and by adding to the hospital staff men with washing-machines. Every convenience exists on a hospital-ship to accomplish this work, or if there be a want of space, a separate vessel should be fitted up for a laundry. The *moral* of a sick man is ruthlessly killed out, if he be vermin-covered.

The plates given here are copies of those attached to Dr. Bleckley's interesting and instructive reports on the 'Victor Emmanuel' hospital-ship utilised during the Ashanti campaigns.

The addition of an ambulance launch, and of definitely constructed ambulance-lifts to the equipment of hospital-ships, will doubtless be made in any future campaign.

CHAPTER XIII.

AMBULANCE TENTS AND HUTS.

Proposals for the more general use of Huts and Tents in infectious disease—The English Bell Tent—The Hospital Marquee—Indian Tents—American Tents—The Tollet system of Tents—The Dœcker Felt Huts.

FOR the protection of sick and wounded in war, portable tents and huts will always be largely used, and the probability is that, even in civil communities like cities and towns, we are only at the beginning of the use of temporary shelters such as tents and huts for housing infectious diseases, surgical operation cases, and other ailments where abundant air is needed.

Hospitals, however well constructed and however sanitary in their surroundings, would benefit by having their wards left empty and idle for a time, and one ready way of doing this is to be able to pitch in the hospital grounds suitable tents, or portable huts, in which during certain seasons of the year most cases could be treated. The military medical service, with its abundant stores of tents, will probably be the first to push this system into a regular practice, and it will be of much use to that service as giving it the opportunity of testing its *matériel* under conditions similar to war service.

There is, unfortunately, an idea in many untravelled Englishmen's minds as to the discomfort of tents; but all of us who have served in India are well aware that comfort can be completely secured under a canvas roof. There is also a sense of freedom from bad ventilation and unhealthy house-conditions very much felt by those who live in tents.

For infectious diseases' treatment, the idea seems daily to gain ground that expensive substantial stone or brick edifices are hardly the most suited, and it will probably be for the housing of such cases we shall see the first steps taken in providing tent or hut-accommodation.

When we remember the extreme difficulty with which scarlatina, diphtheria, and the various infectious diseases are separated in ordinary private houses, is it too much to hope that one day, on the occurrence of such cases in a household, it may be quite easy to apply for a suitable tent, with proper flooring and camp furniture, which could be pitched in the garden or grounds of the house attacked, and where the nurse and the patient would be completely separated from the remainder of the family?

One may compare the feeling on this head to the very common opinion existing in the past, that patients with high temperatures in fever should not be placed in cold baths, lest internal congestions should ensue, and probably the tent treatment of infectious cases, surgical operations, and perhaps of obstetric cases, may one day be quite as common as cold immersion now is in the high temperatures of fever. Tents with double roofs are very common in India, and keep out the heat, and keep in the warmth very well. Stoves are easily used in tents; our hospital marquees have regularly cut floorings that fit the interior; and surely, with all these aids, comfort can be well secured, and segregation be made as complete as it is to-day incomplete. Tents and huts too can be easily disinfected by washing or by heat, and it may one day be possible to receive on loan from the municipal authorities the needful tents required for the treatment of special disease.

The complete manner in which the *dejectæ* can be dealt with in tent hospitals is an important point, as it prevents all use of the house closets.

We may briefly notice some ordinary tents in the following order:—

(*a.*) The Bell or Circular Tent.

(*b.*) The Hospital Marquee.

(*c*.) Indian Tents.
(*d*.) American Tents.
(*e*). The Tollet-system Tents.
(*f*.) The Dœcker Felt Huts.

(*a*.) *The Bell or Circular Tent* is the ordinary war tent of the English army. It is also used for the movable field hospitals in the front, and for the operating tents of the bearer-companies. It is 10 feet high, 14 feet diameter, weighs 65 lbs. and cost £5. It is intended to hold 18 men in war time, 12 at ordinary times.

For hospital purposes it is not appropriate. Four men on stretchers can be laid in it rectangularly, but four is a

Fig. 52.

THE ENGLISH BELL, OR CIRCULAR TENT. THE ENGLISH HOSPITAL MARQUEE.

bad unit for supervision and nursing; and the construction is not favourable to moving about in it for nursing purposes. Its ventilation is defective, and must be so, so long as it has only one doorway.

For the bearer-company operating tent it is useless, as the operating table cannot stand in it, and if it could, the doctors cannot move round it with comfort.

The English Hospital Marquee is the regulation tent for permanent hospitals: it is 28 feet long, 14 feet wide, 12 feet high, and weighs 500 lbs. Its price is about £22 13*s*. at the Royal Arsenal, Woolwich. It is supposed to hold 18 sick, but really takes 10 with comfort. It is a singularly, nay absurdly, difficult tent to pitch correctly. As it is not rectangular, but has rounded ends, the laying out the tent pegs and marking the space needed is a geometrical problem, completely foreign to rapid war-pitching.

Further, it is a clear principle that all hospital tents should be able to join together end to end to form larger combinations. The absurd circular ends of this tent prevent another tent being closed up upon it to form a larger hospital ward. This is very fatal to its prestige as a useful article of equipment, and we should not regret to see it consigned to the flower show or the lawn-tennis ground. For war, it is not the thing we want.

A war hospital-tent should be before everything rectangular, able to join on end to end with other tents, and very easily pitched, so that on a dark night or early morning march it can be pitched or struck without the geometrical problem now needed with our hospital marquee. It should have very few pegs indeed, while our present marquee has a bewilderingly needless number, 184!!!

Indian Tents.—The ordinary Indian *privates' tent* does singularly well for a hospital tent, holding eight men with great comfort. It is rectangular, with two uprights, and one cross-pole supporting the roof. It is used commonly all over the plains of India as a hospital tent.

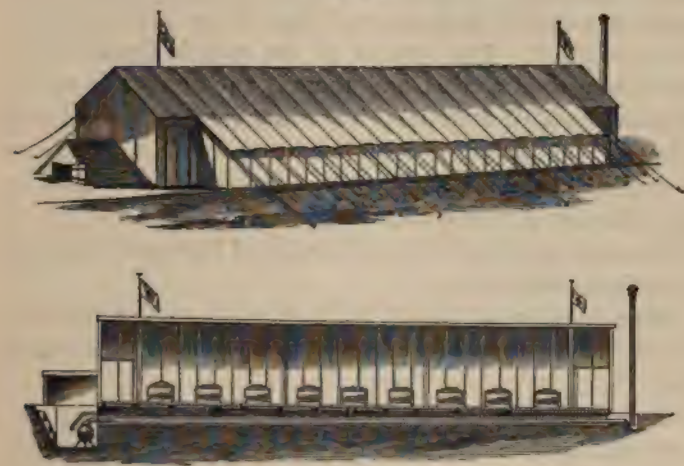
The Lascar Pall Tent was used with much comfort during the Affghan war as a hospital tent. It is easily pitched, and very safe in storm or gales. It is a tent with three upright and one ridge pole, and is like the section of a prism. It holds eight men with comfort in mountain campaigns. Probably it would suit well for any kind of European campaigns as a hospital or operating tent, as the sides can be raised, and there is perfect ventilation.

Mountain Battery Tents.—Some very useful tents are issued to the Indian Mountain Batteries ; they are small and light, and would do well for the staff of the field hospitals.

American Tents.—A plate is here given, showing a favourite shape of American war hospital-tent. A good hospital tent would be made by cutting this long tent into sections holding ten beds, five on each side, with curtains closing the ends. Such section tents could be united, end to end, at any time to form larger combinations.

The system of warming tents for winter campaigns is shown in the lower picture. A furnace is built at one end of the tent in a hole dug in the ground, and the heat is

Fig. 53.

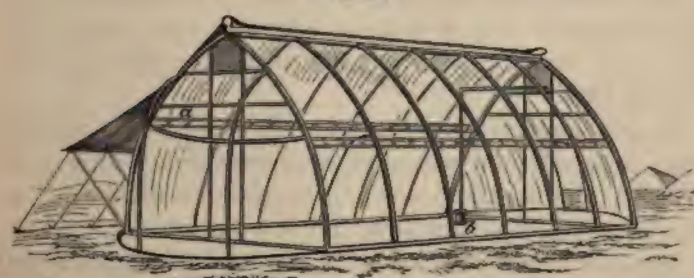


AMERICAN WAR HOSPITAL TENTS.

The upper representing the tents as pitched; the lower showing the system of warming for winter campaign.

carried either by iron pipes, or by a stone-lined or brick channel running under the tent, and ending in a chimney at the opposite end of the tent.

Fig. 54.



FRAME WORK OF A TENT ON THE TOLLET SYSTEM, SHOWING THE IRON RIBS RUNNING INTO A CENTRAL RIDGE-POLE—STOVE AT *b*.

The Tollet-system of ambulance, or hospital tents or barracks, is spoken favourably of, and has been adopted in the French and Italian services (Fig. 54.) The central tent-poles are abolished, and the structure is supported by curved iron ribs running into a longitudinal ridge-pole. The curves are ogival in form, and there is no dead angle of non-ventilation. The interior of the tent is lined with a non-combustible canvas, and there is an external covering of a waterproofed material. The sides can be raised at any place, for ventilation or to form a verandah. A stove can be placed in the interior, and in a Swiss winter is said to keep the tent perfectly comfortable.

The only drawback is the difficulty of transport, but this is not insurmountable.

Inspector-General Mouat, M.D., of the Local Government Board, speaks very favourably of this system of housing sick.

The prices we are unable to state, but the address of the contractors is Société Nouvelle de Constructions Système Tollet, 61 Rue Caumartin, Paris.

The Dœcker Felt Hospital Huts.—This is a system of huts or houses devised by Captain Dœcker of the Royal Danish army. It has received the Gold Medal of the German Empress at the Berlin Hygienic Exhibition of 1883. It consists of light wooden frames, covered with a special felt called Carton felt, lined with canvas.

The fastening of the frames is so simple, that the erection of huts can be very rapidly carried out. The weight is said to be one third that of wooden huts, and they are said to last much longer. The price is about one-third that of wooden huts.

They maintain a very equable temperature, a simple stove being all that is needed to warm them. After use, the tent can be taken down, each panel washed with a disinfectant, and packed away flat in a case.

Professor Esmarch is said to approve of them, and to be himself using them.

Sir Robert Rawlinson has commended them highly.

At the Kings Norton Rural Sanitary Authority, near Birmingham, they are used for small-pox cases, and have given satisfaction.

A hospital hut with ridge ventilators, size 36 feet in length by 16 feet in width, and the walls 7 feet 3 inches, with deal flooring and packing-cases, cost, delivered in London, £175.

The address of the maker's office or agents, is Puggaard and Galschiot, 50 Boulevard Haussman, Paris—to whom those needing further particulars should apply.

CONCLUSION.

THE object aimed at in these pages has been to write so simple a paper on Ambulance Organization, Equipment, and Transport, that the ordinary visitor to the International Health Exhibition of 1884, casually taking up the hand-book, might be able, without difficulty, to gather some idea of the aims and objects, and the difficulties of Ambulance work.

If these pages at all fulfil this aim, the writer will be well rewarded.

CLEANSING STREETS AND WAYS

IN THE

METROPOLIS AND LARGE CITIES.

BY

WILLIAM BOOTH SCOTT,

MEMBER INSTITUTION OF CIVIL ENGINEERS;—CHIEF SURVEYOR TO
THE VESTRY OF ST. PANCRAS, ETC.

MEMORANDUM.

I AM indebted to the courtesy of SIR JOSEPH WILLIAM BAZALGETTE, C.B., for the comprehensive Table between pages 408 and 409, and to MR. D. KINNEAR CLARK for valuable assistance ably rendered in collecting and marshalling some of the general statistics—those especially relating to foreign cities.

WILLIAM BOOTH SCOTT,
M.Inst.C.E.

CONTENTS.

CLEANSING THE STREETS AND WAYS

OF

THE METROPOLIS

AND OTHER LARGE CITIES.

THE health of the inhabitants of a great city must be materially affected by, and to great extent depend upon, the efficiency of means adopted for the removal of refuse; —for the timely and periodical cleansing of the streets and carriage-ways within its precincts, and for the preservation of those thoroughfares free from offence or obstruction.

The work to be done is of itself very simple in its nature, and becomes difficult only by reason of the enormous aggregate quantities to be removed, and dealt with, from overgrown communities; by the want of consideration evinced by the individual members thereof, and in many cases—the Metropolis for example—by the existence of concurrent jurisdiction set up by different Acts of Parliament, the result of slovenly indefinite legislation—legislation that would seem almost to justify the opinions openly expressed by cynical, atrabilarious critics, that the lawyers in Parliament take care that the measures passed shall be so framed and worded as to provide plenty of work for their brethren of the long robe.

DEFECTIVE LEGISLATION.

Concurrent jurisdiction is not the only result of modern insincere and indefinite legislation. Existing Acts are incorporated wholly or partly in Bills under consideration

or altered or repealed by means of "schedules" or otherwise, sometimes in such terms as these :—

"*All the duties, powers and authorities for or in relation to the paving, lighting, watering, cleansing, or improving of any parish mentioned in Schedule* (—) *to this Act, or any part of such parish, now vested in any commissioners, or in any body other than the vestry of such parish, or in any officer of any commissioners or other body, and all other duties, powers, and authorities in anywise relating to the regulation, government, or concerns of any such parish or part, or of the inhabitants thereof* (*except such duties, powers, and authorities as relate to the affairs of the church, or the management or relief of the poor, or the administration of any money or other property applicable to the relief of the poor, so far as such duties, powers, and authorities relate thereto,*) *now vested under any local Act of Parliament in any commissioners, or in any body other than the vestry of such parish, or in any such officer, shall cease to be so vested, and shall save as herein otherwise provided become vested in and be performed and exercised by the vestry of such parish under this Act;*" *&c. &c.*

or by such as this :—

All Acts of Parliament in force in any parish or place to which this act extends, or in any part of such parish or place, shall, so far as the same are inconsistent with the provisions of this Act, be repealed as regards such parish or place, or such part thereof, notwithstanding any provisions of this Act continuing and transferring respectively to vestries of parishes and transferring to district boards any duties, powers, or authorities now vested in vestries, commissioners, or other bodies."

or by such as this :—

"*The powers of improving and regulating streets and for the suppression of nuisances contained in the Act of the*

fifty-seventh year of the reign of His Majesty King George the Third, chapter twenty-nine, local and personal, intituled "An Act for better paving, improving, and regulating the streets of the metropolis, and removing and preventing nuisances and obstructions therein," shall, so far as the same is in force, and is not inconsistent with the provisions of the recited Acts and this Act, extend and apply to the metropolis as defined in the firstly-recited Act and in this Act, including any unpaved streets, and notwithstanding any exceptions therein contained."

CLEANSING IN THE METROPOLIS.

In the Metropolis the duty of cleansing the streets and ways and of employing or contracting with any company or persons for that purpose is imposed upon Vestries and District Boards of Works, more especially by the 125th section of the Metropolis Local Management Act, and special power is taken to refer to such company or persons as scavengers.

A scavenger, according to the great lexicographer, is "a petty magistrate whose province it is to keep streets clean." By the provisions of the statutes conferring powers on Local Authorities (see Appendix A), it will, however, be seen that the functions of the scavenger are more comprehensive. He not only cleanses streets—but is expected to suppress dust, and remove mud, ice, snow, and much else from streets and from houses. These are among his functions by statute, and he is at least supposed to discharge them.

The refuse of streets and houses is heterogeneous in character. Besides the dust, mud, and occasionally ice and snow, there are found paper, rags, old mattresses, jewels, rings (sometimes wedding-rings), meat-tins, straw, cabbage-leaves, onions, bank-notes, apples, turnips, fish-bones, money (gold, silver and copper), dead cats, dogs, rabbits, guinea-pigs, fowls, horse-dung, refuse from slaughter-houses and fish shops, brush-heads, old boots, old books (some rare and

valuable), knives, forks, silver spoons, children's toys, old hats, old bonnets, crinoline wires, umbrella frames, broken pots, broken bottles, preserve jars, and other crockery, medicine-bottles, old tin and iron wares, ashes, cinders, much coal of all sizes, firewood, broken bricks, door-mats, table-covers, floor-cloth, *et cetera.*

OBSTRUCTIONS.

The dirty and incommodious condition of some streets is the result of open violation of the provisions of the statutes. Obstructions are placed on the footways and the carriage-ways; thousands of strolling cab-men are allowed to ply for hire (a contingency which is the unavoidable result of over-licensing, in London there being not standing room for more than half the licensed cabs), adding the cattle-droppings to straw refuse and litter swept out of shops; carpets and mats are shaken in the streets; snow lies on the footways; garbage and refuse cast into the roadways; offensive matters are spilt from carts, and even pigs in some localities are allowed to run about the streets; just as if no prohibiting sections, relative to such nuisances, existed in the Police and other Acts.

It would appear that this irregularity in some respects is, more or less necessarily, connived at by the Police. The placing of costermongers' stalls outside the footpaths of and on the carriage-ways of streets (of great traffic, although not of absolutely first importance), is a practice which results in the rejection of much refuse into the carriage-ways. The toleration with which the stalls are regarded by the Police is an anomaly only to be explained by their undeniable convenience to large sections of the respectable poor, who are thus enabled to invest their limited means to the best advantage. Many shopkeepers entertain the idea that the out-of-door stalls are a hindrance to their trade and interfere with their profits; and any shopkeeper can require the Police to remove stalls from his own frontage. But he cannot cause the removal of the stalls from his

neighbour's frontage; and as no authority has power to cause the removal of the stall, unless at the request of the shopkeepers or frontagers immediately affected, the result is, practically, that the carriage-way, for a width of from seven to ten feet from the kerb, is occupied in permanence by the stallkeepers.

There are many streets of less traffic where costermongers could ply their out-door trades without such serious interference with public locomotion; but, upon the whole, it seems to be regarded as more convenient for the purchasers that the out-door stalls should be planted in the main thoroughfares, and it is questionable, after all, whether they materially damage the business of the shops, for the stall customers belong to a class who could not afford to purchase at all, or so largely, but for the very low prices charged at the stalls.

The positive advantages of the costermongers' stalls must, on reflection, be apparent to every one. They are the means by which the poorer classes obtain large supplies of food at the minimum of cost—sometimes wonderfully cheap. It is astonishing how quickly the news of a "glut in the market" circulates; how speedily the costermongers rush to the market, whichever it happens to be, and how rapidly they disperse throughout the Metropolis, necessarily disposing of their perishable stocks on the same day.

A superabundant supply enables them to purchase cheaply and advantageously; that they can sell cheaply enables them to clear out their stock quickly, and—to the poor—advantageously.

Concurrent Jurisdiction.

In this matter of the costermongers' stalls, as in many others, there is concurrence of jurisdiction with the Police and with the Local Authorities, each often leaving to the other the opprobrium of setting the law in motion. Moreover, it is found by experience to be impracticable to obtain convictions, such as would justify the Local Authorities or the

Police continuing endeavours to enforce the provisions of the various enactments for preventing the obstructions. In this matter of costermongers, as in the case of removal of snow, the residents or shopkeepers persist in defying the law; numerous summonses excite the anger of a magistrate; whereas, on the contrary, a few summonses, taken out against typical offenders, are likely to be held up as evidence of persecution direct against particular individuals.

Concurrent jurisdiction is the fruitful cause of much inconvenience, and indeed neglect, especially where the enforcement of penal clauses is involved, as the executive officials of the respective authorities are naturally anxious to leave to others the invidious duty of applying stringently the punitory enactments of the statutes.

EXAMPLES.

CLEANSING FOOTWAYS.

The duty of enforcing the *Cleansing of Footways* from mud and snow by occupiers, is placed upon the Police by the Police Act, 1836. The same duty is imposed upon the Vestries and District Boards by the General Paving (Metropolis) Act, 1817, by incorporation with the Metropolis Management Act, 1855, "as far as may not be inconsistent;" by which latter Act also the Vestries and District Boards *may* do the work themselves. The execution of the work by the Local Authorities is not compulsory, but only permissive. Authorities that frequently omit to do work that the statutes declare they *shall* do are not likely to do that which it is enacted only that they *may* do; and so it remains undone, and not one occupier in a thousand ever causes the footway in front of his premises to be cleared of mud.

COSTERMONGERS.

The *Regulations of Costermongers* is generally understood to be the duty of the Police, as the Traffic Regulation Act of 1867 gives the Chief Commissioner of Police

power to make regulations for control wherever stalls are allowed to be pitched in what are called market streets ; but the concurrent powers of the Vestries under the Metropolis Paving Acts, by incorporation, are not impaired, and they hold the right equally with the Police to prohibit the placing of goods for sale on the public way, whenever it is deemed expedient.

OBSTRUCTIONS.

Obstructions caused by shopkeepers exposing goods for sale on the public way are controlled by the Police, under their Act of 1839, and by Vestries, under powers by succession under the Metropolis Paving Act, 1817 ; but each use discretion in selecting cases for proceeding. Increasing apathy is evident on the part of the Police, by a tendency to shift responsibility on to the Vestries, whose proceeding under the statute is discretionary, while the Police are absolutely enjoined to take action against offenders, but in general abstain from action.

PROJECTIONS.

Projections into Streets, which may constitute annoyances or obstructions, are touched by the Metropolis Local Management Act of 1855, as well as by the Metropolis Paving Act of 1817 ; while those which constitute distinct obstruction are also under the control of the Police under the Act of 1839, and the District Surveyor's powers, under the Building Act of 1855, applies also to the same projections.

PIGS.

The *Keeping of Pigs* in the Metropolis is controlled by Vestries and District Boards of Works, specifically under the Metropolis Paving Act, 1817, and generally by the various Nuisance Removal Acts passed since 1855 ; and the Police have power in certain cases under the Police Act of 1839.

Sweeping Slop into Gullies.

The offence of *putting slop or mud down gullies* and sewers is punishable by action on the part of Vestries, under the Metropolis Local Management Act, 1855, and by the Metropolis Paving Act, 1817; concurrently by the Police, under the Act, 1839, it being an offence that calls for much vigilance; and the Metropolitan Board of Works have also like power, so far as the offence may affect the sewers under the jurisdiction of that Board.

CONSTRUCTION AND MAINTENANCE OF ROADS.

IT has frequently been remarked, that well-made and well-kept roads are at the root of civilization. No nation ever made much progress in civilization that neglected its roads. The Turk, certainly, was never a road-maker.

Round boulder pebbles, such as may still be found in neglected ways in the poorest districts of large towns in England, paved probably two hundred or three hundred years ago, would constitute a first class Turkish road. So in Egypt, where dust lies on the roads a foot thick, and when visited—on rare occasions, it is true—by heavy showers of rain, the mud so formed constitutes a formidable impediment to locomotion.

The desire for progress, indicative of the advance of civilization, will beget attention to the construction and maintenance of good roads—the existence of good roads will facilitate the advance of civilization.

Macadam introduced the system of forming roads of broken stones of uniform size ; and roads on this principle serve admirably for highways in country districts.

Roads on this principle have also been laid in the streets of the Metropolis, and of nearly every town in the kingdom. For thoroughfares of small traffic in cities they answer comparatively well ; but under heavy traffic a macadamized road becomes but a mill, the stone being ground up in wet weather into mud, and in dry weather into dust.

London street mud is a noxious and destructive compound, injurious to clothing, to carriages, and to harness. It has been stated by Mr. H. Graves, the eminent print

publisher, that he can clean an engraving from oil, or from ink, or from ordinary dirt, but not from London street mud. To casual observers it is a matter of surprise where all the mud comes from.

The test of comparative excellence in paving is the quantity—more or less—of mud seen upon the surface. The mud found upon a paved street is not so much the result of the wear of the pavement, as of the working upwards of the sub-stratum through defective foundation upon which the pavement has been laid. This applies to wood as to stone pavements. The imperfect foundations supply, however, only a part of the refuse that accumulates in the streets. The dust and mud of the streets of great towns consist, in addition, generally of four ingredients: stone, horse-droppings, shoe-iron, and shoe-leather. House-refuse is not an unknown element; it counts for something in the mass of stuff that is collected in and removed from the streets and roads. Dr. Letheby, in 1867, analysed dry mud from the streets of the City of London, dried by exposure for many hours to a temperature of from 266° to 300° F. At the same time he analysed for comparison samples of well-dried fresh horse-dung and common farm-yard-dung. The results of the analyses are given in the following table.

COMPOSITION OF MUD FROM STONE-PAVED STREETS, HORSE-DUNG AND FARMYARD-MANURE, DRIED AT 300° FAHR.

Constituents.	Fresh Horse-dung.	Farm-yard Dung.	Mud from Stone-Paved Streets.		
			Maximum Organic. (Dry weather.)	Minimum Organic. (Wet weather.)	Average.
	per cent.	per cent.	per cent.	per cent.	per cent.
Organic . .	82·7	69·9	58·2	20·5	47·2
Mineral . .	17·3	30·1	41·8	79·5	52·8
	100·0	100·0	100·0	100·0	100·0

The higher proportion of mineral matter in wet weather, shown in this table, proves that in such weather the abrasion of stone and iron is greatest. Dr. Letheby estimated that the average proportions of stone, iron, and dung in the dried muds were—

	Per cent.
Horse-dung	57
Abraded stone	30
Abraded iron	13
Total	100

The mud was so finely comminuted that it floated freely away in a stream of water.

In mud produced on wood pavements in the City of London, the proportion of organic matter naturally was larger than in that produced on stone pavements, the proportion amounting to about 60 per cent.

The variation in the amount of moisture in the mud of stone pavements was found to be (according to the state of the weather) thus:

MOISTURE IN MUD OF STONE PAVEMENTS.

In the driest weather . .	rarely less than 35 per cent.
In ordinary weather . .	„ $48\frac{1}{2}$ „
In wet weather . . .	„ 70 to 90 „

A far greater proportion of the detritus of macadamized roads is, however, composed, as may reasonably be expected, of the abraded material of the roadway itself. A cubic yard of broken stone metalling of the ordinary size—2 inches or $2\frac{1}{2}$ inches cube—when screened and beaten down in regular layers 6 inches thick, contains, according to the late Mr. Joseph Mitchell, of Inverness, 11 cubic feet of interspaces, as tested by filling in with liquid. Herr E. Bokeberg, of Hanover, made many careful experiments to ascertain the proportion of vacuity to solid material, and found that in a loosely-heaped cubic yard of broken stones, void space amounted to one-half of the total volume. With stones that had become rounded at the edges and corners by wear, the vacuities were reduced to 37 per cent.

2 D 2

of the gross bulk, or to 10 cubic feet. These results would seem to indicate that the interspaces in the case of new stones were reduced by compression to nearly the same volume as was attained after the edges and corners had been rounded by exposure to wear. The original mass of 16 solid cubic feet of broken stone is, in fact, crushed into fragments of every variety of form, eventually down to the finest particles, producing mud, a small proportion only of the stones remaining of their original dimensions.

Mr. Mitchell gives the result of an analysis of $2\frac{1}{4}$ cubic feet of the macadamized road in the Mall in St. James's Park, which was taken up for examination. The component parts of the sample were carefully separated and classed, when it was found that one cubic yard contained:

	Cubic feet.	Per cent.
Mud	11·00	41
Sand, with pebbles not exceeding $\frac{3}{16}$ inch thick	2·40	9
Stones from $\frac{3}{16}$ to $\frac{1}{2}$ inch . . .	6·56	24
Stones from $\frac{1}{2}$ to 1 inch . . .	4·48	$16\frac{1}{2}$
Stones from 1 inch to $2\frac{1}{4}$ inch . .	2·56	$9\frac{1}{2}$
Total volume 1 cubic yard, or .	27·00	100

From the analysis it appeared that less than $9\frac{1}{2}$ per cent.—say one-tenth—of the original stone escaped unground; whilst 40 per cent. of it was reduced to a state of mud. Even these proportions, taken as they stand, are too favourable for the duration of the stone in that instance, for no doubt the sample was a specimen of what remained of the stone, after much of it had been swept or washed out of sight. Mr. Ex-Sheriff Burt, who, commencing his career with the great road-maker McAdam, has the experience of a long lifetime in road work of every description, cannot be much amiss in his estimate that one third of the loose road material used in London is literally wasted by being ground up under the traffic before the consolidation of the surface is effected.

By far the greatest proportion of the detritus of macada-

mized roads consisting of the worn material of the road, the important principle was early revealed by experience, "that the oftener the streets are cleaned the less is the mud which is created and removed, whilst the attendant expenses are by no means increased, and the roads are kept in a better state of preservation." The principle is, besides, deducible from the fact that the loose particles, if left on the surface, act as a grinding powder under the wheels and the horses' feet, to reduce to similar powder the surface of the road, and that the mud which is formed with the detritus when rain falls upon and is mixed with it, operates as a sponge in retaining the moisture on the surface. The crust as well as the sub-stratum, under the circumstances, becomes saturated with moisture, softened, and "rotten," just as a gravel foot-path, hard and solid in ordinary weather, becomes sodden and pulpy when it is lapped for a time by a covering of half-melted snow. The macadamized carriage-way thus reduced, is by the traffic exposed to rapid deterioration, which increases with an accelerated ratio, producing an increased quantity of mud. These conclusions are strengthened and supported by statistics. Shortly after Sir Joseph Whitworth introduced his street-scraping machine in Manchester, it was ascertained by calculations made by the Municipal Authorities on the relative advantages of machinery and manual labour, that by cleansing the macadamized streets with the Whitworth machine three times a week, the quantity of mud produced on the surface was only one-fifth of what was produced when they were swept by hand twice in three weeks. The following are the comparative results.

MACADAMIZED STREETS.

MANCHESTER. Area of district, 5,500,000 square yards.

	Loads removed.	Average area swept to produce a load.
Swept by machine three times a week	1285	4388 square yards.
Swept by manual labour twice in three weeks, Township 1841–1842	6400	859

It was demonstrated by experience that, by the use of sweeping machines, with the proper use of water, a saving of fully one-third of the material required for the repair of the roads was effected in one particular district in the Borough of Birmingham.

Careful comparative tests of Smith's horse-sweeping machines versus land labour were made in the parish of St. Pancras in 1862, the leading results of which showed that a horse-machine, tended by four sweepers, sweeps an area equal to that swept by twenty-four men in the same time; and that the machine sweeps the surface so much more effectively, that it gathers up sixty loads as against forty-one loads swept up by manual labour. Each machine costs £30, and a horse and a man to drive cost 10*s.* per day. Eight machines would cost £240, and supposing that the machines were used on twenty days in the year, for dealing with exceptionally heavy slop, the annual cost was estimated as follows:—

8 machines, £240; 10 per cent. wear and tear.	£24 0 0
20 × 8 horses = 160, at 10*s.* per day . .	£80 0 0
Per year	£104 0 0

The evidence of the exceedingly greater wear of a macadamized surface than of a stone-paved surface is strikingly exhibited in the contrast of the comparative costs for cleaning the two kinds of surface. Mr. Royle states that in the spring of 1870 there were laid in Chester Street, Manchester, 10,000 square yards of granite pavement, and an area of equal extent of macadam. The condition of cleanliness of each was maintained uniform throughout the period of trial by sweeping, for which the respective costs were 9¼*d.* per 1000 square yards and 5*s.* 2½*d.* per 1000 square yards, being in the ratio of one to seven. The average cost for the whole year averaged in the ratio one to five. The great bulk of the excess for macadam, compared with pavement, must

have been due to the vastly augmented wear of macadam granite.

Whilst the greater proportion of the mud of macadam consists of mineral refuse, the detritus of the material of a granite pavement constitutes but a small proportion of the total quantity of the mud-forming dust. Colonel Haywood strikingly exemplified this proportion on the granite pavement of London bridge, three-inch Aberdeen granite sets, which was removed in 1851, after nine years' wear. The average loss of granite, on an area of 3950 square yards, he estimated was equal to two inches of vertical wear. The total volume of granite worn away was therefore about $219\frac{1}{2}$ cubic yards, assuming that the surface was a continuous mass of granite, though there was of course a considerable superficial area of joints. Assuming that the granite worn off was reduced to a state of fine powder, it was increased in bulk probably one-half, and its volume had been $(219\frac{1}{2} \times 1\frac{1}{2} =)$ $329\frac{1}{4}$ cubic yards. Adding 5 per cent. for the loss upon stones removed and replaced from time to time, the total quantity worn off and reduced to powder, and carried away, mixed with the dust of the street and mud, would only have amounted to 345·7 cubic yards for nine years, equivalent to an average of ·105 cubic yard, about one-tenth of a cubic yard per day. Whereas the quantity of dust removed daily, in dry calm weather, was from three to three-and-a-half cubic yards—above thirty times as much as the granite detritus. So much for horse-droppings, shoe-leather and iron, which must have contributed 29–30ths of the total accumulation. Of course in inhabited streets the house-refuse supplies considerable addition.

An approximate estimate of the comparative manurial value of the refuse from streets of stone pavement, wood pavement and macadam, may be based upon the preceding conclusions on the relative wear and tear, and the mud constituents. And first of stone pavements. The mud of paved streets contains from 35 per cent. to 90 per cent. of moisture, varying according to the state of the weather

and the condition of the streets. The mean between these extremes, say 60 per cent. of moisture, may be taken at the average for calculation, leaving the balance 40 per cent. of solid matter. Fifty-seven per cent. of this proportion, according to Dr. Letheby, consists of horse-droppings, and therefore 57 per cent. of 40 per cent., or 22·8 per cent. of the mud collected, is the proportion of the manurial elements. The dried mud of wood pavements contained 60 per cent. of organic matter; a little more than was found in the mud of stone pavements, equivalent to 24 per cent. of mud in average condition.

As it appeared from the results of Mr. Royle's observations that the quantity of mud collected from macadam was from five to seven times that collected from stone pavement, the proportion of organic matter on the basis of the observed proportion for stone pavements would not exceed an average of 4 per cent. of the whole quantity of mud collected from macadamized roads.

In support of the seemingly large average percentage of horse-droppings in the mud of the City streets, it may be added that in the parish of St. Pancras the "dry sweepings" from paved roads, whether of granite or of wood, have been estimated to contain 75 per cent. of horse-droppings.

Magnitude of Quantities to be dealt with.

An idea of the magnitude of the question of street-refuse in the Metropolis may be gathered from the comprehensive, but not exhaustively complete, table annexed, showing for each parish or district in the year 1878 the nature of the roadway formation, and the lengths of streets and roads constructed with granite paving, macadam and gravel, asphalte, wood and flagging; the number of catchpits, and the quantity of solid deposits in catchpits and sewers; the number of cart-loads of mud and dirt removed from the roads, streets, and alleys; also the

...ten ...ed ...ly.	Catchpits under Gullies. Capacity in cubic yards.	Number.	Cub. interc... a... rem... annu...	...rials used. ...int.	Hoggin.	
				...Tons.	Yards.	Tons.
...ntly	No information	No information		..	..	..
	½	1,961	11	..	..	..
	¾	5,500	4	..	..	..
	1	2,000	8	..	..	..
...ntly, ...mes	½	1,486	2	..	..	..
	¾	2,121	6	..	..	..
	½	3,000	1	..	6,500	..
...con- ...say 4 ...s	½	2,100	4	..	896	..
	½	648	3	..	..	..
	⅓	2,918	5	..	7,183 5,786	..

...ards per year per mile of length, taking the length

quantity of material, broken granite, broken flint, and hoggin, used in maintaining the roadways.

From this table it appears that there was, in 1878, the length of about 1670½ miles of roads and streets in the Metropolis, of which there were in round numbers—

	Miles.		Per cent.
Granite pavement . . .	284½	or	17
Macadam and gravel . . .	1330	"	79·6
Asphalte	9½	"	0·6
Wood	14	"	0·8
Flagging	32½	"	2·0
Total length . . .	1670½	"	100

Since the date of this statement, wood paving has been considerably extended in some of the principal thoroughfares. The quantities of refuse collected from the catchpits, drains and streets in the same year, were as follows :—

Year 1878.		Cubic yards.
Mud and dirt removed off roads, streets, etc. .		603,192
Deposit removed from sewers :—		
Local sewers	8,233	
Main line sewers	12,087	
		20,320
Deposit intercepted by, and removed from catchpits		143,704
Total (882,298 tons) . . .		767,216

The quantity of refuse removed off the roads, streets, and alleys, averages 361 cubic yards per mile of way for the year. It may well be imagined that the maximum rate of accumulation and removal of refuse is something very much beyond the average rate. On London Bridge, for instance, it has already been stated that the collection of refuse, without the contingency of escaped house-refuse, averages from three to three-and-a-half cubic yards per day, which, if reckoned up, represent accumulations of 8000 cubic yards per year per mile of length, taking the length

of the bridge at 261 yards. In the City of London, from 48 miles of streets, 30,000 cubic yards of slop were collected in the year 1879–80, being at the rate of 625 cubic yards per mile of street. In Newington, as a contrast, 60 cubic yards per mile was the rate of slop-lifting.

The gross quantities of material used, in 1878, for maintaining the streets and roads of the Metropolis were :—

	Cubic yards.
Broken granite	164,444
Broken flint	59,262
Hoggin	50,619
Total used	274,325

This quantity bears a very high ratio to the volume of slop and deposit lifted during the same year, already stated to be 767,216 cubic yards. It is 36 per cent., or more than one-third of the volume lifted, that is to say, the volume of slop and deposit together is scarcely three times the volume of the material from which it is produced. But it is necessary, in order to form a closer comparison, to take the solid volume of the broken material, which is, say, one-half of the volume in bulk, which then becomes more than one-sixth of the volume of slop and deposit. This proportion, still very high, and not encouraging from the manurial point of view, is due to the great preponderance of macadam and gravel in the construction of the streets, amounting to four-fifths of the entire length of way.

DOMESTIC REFUSE.

In addition to the "slop," as it is called, comprising, when the word is used in a general sense, the road and street refuse, wet or dry, the "dust" or domestic refuse is to be estimated. The following tabulated returns from five metropolitan parishes, showing the loads or cubic yards of dust in comparison with the loads of slop, in recent years, afford probably a means of forming a fair average proportion of "dust" to "slop :—

	Cartloads of Dust.	Cartloads of Slop.	Total Cartloads.	Street Mileage.	Cartloads per mile.
Islington . . .	28,113	22,230	50,343	98	514
Chelsea	8,615	9,473	18,088	32	565
Paddington . .	16,830	26,380	43,213	43	1005
St. Pancras . .	25,000	45,000	70,000	80	874
City of London .	27,000	30,000	57,000	48	1188
Totals . .	105,558	133,086	238,644	301	793
Averages per Mile	351	442	793		

The average quantity of slop in these five parishes is shown to amount to 442 cartloads or cubic yards per year per mile of way. The gross average quantity for the whole of the Metropolis is, as already stated, 361 cubic yards per year per mile; and the probable corresponding quantity of "dust" or house-refuse may be estimated by the rule of three. If the average quantity of dust produced by the five tabulated parishes, 351 loads, be reduced in the ratio of 442 cubic yards to 361 cubic yards, the resultant quantity 1351 $\times \frac{361}{442}$ = 1287 cubic yards is the gross average of "dust" or house-refuse per year per mile of way. Multiplied by the total length of way in the Metropolis, 1670½ miles, the estimated quantity of house-refuse becomes (287 × 1670½) = 479,434 cubic yards per year. The respective quantities of slop, deposit, and dust collected in the year 1878, may, from the foregoing data, be estimated as in the following table:—

STREET AND HOUSE REFUSE IN THE METROPOLIS, 1878.

Refuse.	Total for the Year.	Per Mile of Way.	Per Mile per Day.
	cubic yards.	cubic yards.	cubic yards.
Slop.	603,192	361	1
Deposits in catchpits and sewers.	164,024	98	¼
Slop and deposits	767,216	459	1¼
Dust or house refuse	479,434	287	¾
Totals	1,246,650	746	2

The magnitude of the work of removal of street and house refuse is here made apparent :—1,250,000 cubic yards for the year ; daily, 3,416 cubic yards ; 2 cubic yards for each mile every day. The dust or house-refuse is three-fourths as much as the slop from the surface of the street ; and the stuff which flows into the gullies is one-fourth as much as the slop which remains on the surface, or it is one-fifth of the whole of the refuse generated in the public ways. The considerable proportion of matter thus withdrawn from the surface by natural gravitation, and settled in the çatchpits and sewers, is evidence of the evil of infrequent cleansing of the road surface ; for so large a proportion thus withdrawn from the reach of shovel and broom to fester unseen, could only have been translated beneath the grid as a result of avoidable accumulation at the surface. A few instances from the table may serve to illustrate the question. In the City of London, paved entirely with granite, asphalte, wood, and flagging, of the 33,272 loads of slop and deposit removed, 3272 loads were taken from the catchpits and sewers,—about 10 per cent. of the whole quantity. In the parish of Chelsea, in which the streets are laid almost entirely with macadam, of the 18,840 loads of slop and deposit removed, 8040 loads were lifted from the catch-pits and sewers, being 42 per cent. of the whole quantity removed. To what extent this enormous and illegitimate precipitation of refuse underground was avoidable, it is impossible accurately to estimate ; but evidently much of it, at all events, is attributable to the character of the way, and it supplies a powerful argument in favour of frequent thorough cleansing of the street surface.

STREET CROSSINGS.

A part of the street surface of great cities not usually attended to with due regard to the comfort and convenience of the public is that comprised in crossings.

The Metropolis Management Act, 1855, empowers vestries and other local authorities in the Metropolis to appoint crossing-sweepers by the following provision :—

> It shall be lawful for every Vestry and District Board to appoint and pay, or for two or more Vestries and District Boards to unite, when necessary, in appointing and paying suitable persons to cleanse and sweep, and to keep properly cleansed and swept daily, crossings for passengers over the streets and thoroughfares within their respective jurisdictions, and in such situations as the said Vestries or District Boards may from time to time fix and determine, which persons so appointed shall be distinguished by their dress or some distinctive mark as public servants.

It is a curious fact that although many complaints are constantly made of the objectionable characteristics of the semi-beggars who infest many crossings in all parts of the Metropolis, and of the unswept condition of other crossings in public thoroughfares of considerable traffic, no local authority has yet thought it expedient to put in operation this provision of the Act, by which many a respectable person might be placed in a position to earn sufficient to maintain himself and family in comfort, without any assistance from direct parochial relief.

A person so appointed would, by civil behaviour and proper attention, soon become the recipient of regular though perhaps small contributions from pedestrians frequently passing, who would willingly and gratefully recognise the comfort and cleanliness of a well-swept crossing, and others would perchance generously appreciate the difference between the respectable though humble crossing-sweeper, and the insolent rough, who, in the absence of alms, indulges in whining appeals for pence, or in foul-mouthed abuse and persistent entreaties.

"A MAN'S A MAN FOR A' THAT."

There are, however, among the crossing-sweepers, even under the existing haphazard and no-system, many not to be entirely reprobated.

The man who sweeps an ordinary crossing has safe, straightforward work to do. The man who undertakes the crossings at the intersection of great-traffic carriage-ways, has often a difficult and dangerous piece of work to perform, especially where the intersections are not at right angles and directly opposite, or where diagonal intersections converge.

This man, if skilful in "doing a little bit of fancy work round a corner," regards himself as much an artist as he who chalks blue seas, green moons and neutral portraits on the footway flagging, and the pride of skill is even to be found in the humble "scoopman," who ladles up liquid mud, and with a clever, ingenious but unregarded turn of wrist drops it into the cart without scattering a single splash upon the garments of the passers-by, and who would scorn the clumsiness of

> "Dick the scavenger [who] with equal grace
> Flits from his cart the mud in Walpole's face."

In the definition already quoted, Johnson recognised the fact that the humblest labourer in authority in the all-important work of cleansing and keeping clean thoroughfares of a great hive of civilized life was an entity of some importance.

As the more exalted classes should be expected to act up to the principles of the proverb—

> "Noblesse oblige"—

so may the small magistrate take to himself, and live up to, the principles enunciated in the couplet:—

> "Honour or shame from no condition rise,
> Act well your part—for there true honour lies";

and may with proper complacency reflect that he may be the more honest, straightforward man, although he has to remove the broken pie-dishes of a Premier, or the cast-off buttonholes of a Home Secretary.

DRINKING FOUNTAINS.

In the streets of the Metropolis, as in other great cities, it may also be remarked that other opportunities exist for enabling many disabled, but respectable persons, to obtain subsistence without recourse to parochial relief, in connection with the Drinking Fountains scattered over the Metropolis by the philanthropic efforts of the Metropolitan Drinking Fountains and Cattle Trough Association, and and by other agencies in the provinces.

The benefit of these admirable institutions would be manifestly and immensely increased if arrangements were made for a respectable old person to be allowed to sit by the side of a drinking fountain with a small table and with some drinking glasses. Many persons would take advantage of a clean glass, who would otherwise pass by, objecting to allay their thirst from the public ladle. The attendant should not, of course, be allowed to assume anything like proprietorship of the fountain, and should be prohibited from making any charge. The voluntary contributions for the use of a clean glass would be something appreciable, notwithstanding the meanness that unfortunately so generally prevails in a highly civilized community.

UTILIZATION OF REFUSE.

In considering the question of the utilization of street and house refuse, it must be borne in mind that street-scrapings vary very much in character, depending upon the season of the year, and the nature of the carriage-ways. There are two processes for utilization generally adopted in large cities of England that, in default of more euphonious terms, may be described as the "shoot" process and the "sifting" process. The "shoot" process consists in removing the refuse by railway or by water, to be shot on some piece of waste ground. By this means land, which otherwise has little or no commercial value, is in time converted into land capable of producing garden or agricultural produce. It is from the augmented, or rather created, value of the land thus systematically made valuable, that profit can be expected, and when the time arrives for the treatment of this subject in a comprehensive and statesmanlike manner, such a scheme, could, for the Metropolis, be fully and advantageously developed by arrangement with railway authorities, and the construction of depôts, convenient sidings, and works contingent.

The "sifting" process for dust, or house-refuse, is in daily use in most metropolitan and other yards. It consists in riddling the dust through sieves, either by machinery or by hand. It is separated into "breeze," "ashes," iron and other metallic products, rags, white glass, black glass, bones, "hard core" (broken pottery, &c., suitable for the foundations of roads and streets), "soft core" (garbage) and sundry other matters. All these constituents, excepting the soft core, are saleable. The soft core is required either to be cremated or to be worked into manure to render it

inoffensive and marketable. The cost of this process varies, but it is done by contract at rates averaging 10*d.* per load of 1¼ cubic yards of dust.

The following are approximately the cost and the price realised from the sifted refuse of Paddington parish, exclusive of the cost of cartage to the depôt, and general charges. The Paddington "dust" is considered to be the best procurable at West Drayton, whither it is conveyed by canal.

	Per ton. *s.*	*d.*
Breeze and ashes sifting	1	3¾
Canal dues to West Drayton	1	2
Barge hire, and wages of bargee, etc.	0	8
Total	3	1¾
Average price 2*s.* 9*d.* per chaldron, or 3*s.* 0¾*d.* per ton	3	0¾
Net cost of sifting breeze and ashes, and delivery at West Drayton	0	1
Street-sweepings and slop:—		
Canal dues to West Drayton	0	7
Barge hire, and wages of bargee, etc.	0	6
Charge for shoot at West Drayton	0	4
Total cost of disposing of street sweepings and slop	1	7

The general question of the disposal of street and house refuse to the best advantage came recently under the consideration of the Vestry of St. Pancras, and the general results of the inquiry may be briefly recorded.

In St. Pancras, in which there are about 80 miles of carriage-way, the proportions of the several kinds of roadway are as follows:—

ST. PANCRAS.

	miles.		per cent.
Granite pavement	19	or	23·8
Macadam and gravel	58½	"	73·5
Asphalte	⅛	"	0·2
Wood	½	"	0·6
Flagging	1½	"	1·9
Total length of way	79⅝	"	100·0

These lengths do not differ very much in their proportion from those of the Metropolis taken as a whole, as already stated at page 17, and for the present purpose the statistical details of the street-refuse of St. Pancras parish may be adopted as typical of those of the Metropolis generally. It is shown above that the granite and other paved surface occupies nearly one-fourth of the way, and the macadam nearly three-fourths.

With respect to the different classes of material to be dealt with, it may be stated that the dust and slop together amount to 70,000 loads or cubic yards per year, which, according to carefully-prepared returns, is divisible into :—

	Loads or tons.
Road-sweepings or "slop"	45,000
Dust from the ashpits.	25,000
Together	70,000

The road-sweepings, varying in character, may be subdivided as follows, giving a fair approximation :—

	Loads or tons.
Sweepings from paved streets in dry weather .	9,000
Sweepings from macadamized streets in dry weather	18,000
Slop from the streets in wet weather	18,000
Total sweepings and slop.	45,000

Sweepings from Paved Carriage-ways.

Dry sweepings from paved streets contain a large proportion, about 75 per cent., of horse-droppings, and it is found that they are saleable for top-dressing, when well dried, at a price of from 3*d.* to 7*d.* per ton, free of charge for railway or canal dues. By judicious manipulation the sweepings could be advantageously mixed with stable-manure, the commercial value of which is from 2*s.* to 5*s.* per ton, free of charges for transport.

Stable-refuse is a considerable item of town-refuse which

has not yet been referred to. In the parish of St. Pancras, alone, it is estimated that at least 10,000 loads or tons of stable-refuse is produced annually, being upwards of 20 per cent. on the weight of the street-refuse. But it is to be borne in mind that this, the stable-refuse, belongs to the producer, and also that the authorities are not bound to remove it. It occasionally fetches a high price, and it would be a convenient medium by which to increase the value of the sweepings of paved streets. It has been estimated that about half the quantity produced, or 5000 tons per year, could be secured, free of any charge but the cost for cartage; and there appear to be about equal facilities in the western and northern markets for disposing of any quantity of pavement-sweepings and stable-manure to market-gardeners and others. The following estimate of the receipts from the sale of these items of refuse is based upon the results of careful enquiries. It is assumed that of the 9000 loads of dry pavement-refuse, one-half, or 4500 loads, are mixed with the 5000 loads of stable-refuse available free of charges. Cartage is estimated for transport to a convenient site at Paddington, or at Belle Isle:—

	£	s.	d.
Sale of 4500 cartloads or tons of dry pavement-sweepings, containing less than 75 per cent. of horse-droppings, at 5*d.* per ton . . .	93	15	0
Sale of 9500 cartloads or tons of a mixture of dry pavement sweepings (4500 tons), and stable-manure (5000 tons), containing about 75 per cent. of horse-droppings, at 3*s.* 6*d.* per ton	1712	10	0
	£1806	5	0
Less cost of cartage for 5000 cartloads of stable-manure at, say, 9*d.* per ton, on $1\frac{1}{2}$ miles average distance for cartage	187	5	0
	£1619	0	0

Total annual value of dry pavement-sweepings and stable-manure, say, £1600 per year.

SWEEPINGS FROM MACADAMIZED CARRIAGE-WAYS.

The sweepings from macadamized streets are of two classes: those of streets which are repaired with gravel or flints, and those of streets repaired with broken granite. Of the 18,000 loads of dry sweepings in St. Pancras, it is estimated that 3600 loads consist of gravel and flint, which can readily be disposed of to builders. As the whole of the uncovered building land in that particular parish is on a clay subsoil, sand suitable for building purposes and plastering is expensive, owing to the heavy cost of carriage from a distance. The gravel and flint sweepings would consequently be readily sold in the yard, when well dried and sifted, at from 2*s*. 6*d*. to 3*s*. per yard.

The sweepings and scrapings from granite macadam ways would be of less value; but they could be made available for the same purpose by a process of washing, by which a proportion of good sharp sand could be obtained, worth about 2*s*. 6*d*. per cubic yard; also a proportion of granite and gravel stones, valued at 6*s*. per cubic yard. The remainder, mixed with burnt "hard core" and sifted, would sell at about 1*s*. 3*d*. per cubic yard, the residuum mud being available as manure.

The slop removed from the streets in wet weather is, when first removed, a bulky and heavy item. Its constituents are essentially the same as the dry sweepings and scrapings, plus water.

The 18,000 cart-loads of slop, as estimated, may be subdivided in the following proportions:

Pavement slop	6,000
Macadam slop	12,000
	18,000

This slop contains fully 50 per cent. of water, which can be separated by partial drying on filter-beds, leaving but half the bulk to be dealt with.

The 6000 loads of pavement slop, when dried, can be

mixed with the inferior dry pavement sweepings, and be so disposed of.

The 12,000 cart-loads of macadam slop can be passed through the wash mill—such as is employed in Islington parish, to be subsequently described—either when first received in the yard, or subsequently after deposit during heavy weather. By means of the wash mill the sand and stones are separated from finer matter, from which the water is strained off on filter-beds.

HOUSE REFUSE.

Having so far discussed the disposal of the street-refuse, there remains for consideration the "dust" or "house-refuse," of which there is an annual production of 25,000 loads in the parish of St. Pancras alone. For the utilization of the dust it requires to be sifted and sorted, for which the employment of a great number of hands is required, although, as an alternative, the sifting could be done more economically by machinery moved by steam-power. The products are estimated from data derived from the experience of the Paddington depôt wharves as follows:

"DUST."

	Tons.
Breeze, suitable for brick-making, 2450 chaldrons, or	9,898
Fine ash siftings, called by brickmakers "ashes" or "soil"	18,558
Hardcore, consisting of broken pottery, and suitable for road making	959
Old iron, tin, and other metallic products	2
Old boots, and sundry assorted articles	2
Rags	67
Black glass	81
White glass	16
Bones	31
Paper, straw, cabbage-leaves, etc., are known as soft core	1,636
Total "dust," 25,000 cartloads, averaging $1\frac{1}{4}$ tons each, or	31,250

The "breeze" and "ashes" or "soil" are the largest and most valuable products of the "dust," but they require, for the most part, a country market. It is assumed that the proceeds of the sale of breeze and soil would only cover the cost of manipulation and burning the surplus. A furnace should be erected for the purpose of consuming all soft core and such ashes as there may not be an immediate demand for. The ash from this furnace would, when sifted and mixed with washed macadam-sweepings, find a ready market at about 1*s.* 3*d.* per yard. It would be available for use with Moule's earth-closets. The "hard core," the third in magnitude of the non-perishable products of dust, can readily be utilized as a foundation in road making.

Against the estimated receipts, £1600, by the sale of stable manure and pavement sweepings, would have to be set off the estimated cost for cartage of 70,000 cartloads to a depôt at Paddington or Belle Isle, with other annual charges, amounting together to £6250, irrespective of general superintendence. There is also to be set off the annual cost of removing "slop" and "dust," which in the year 1879–80 amounted to £13,937 for the parish of St. Pancras, distributed thus:—

			£		*s.*	*d.*	
Cleansing	45,000	loads of "slop"	7750,	or	3	5·3	per load.
Dusting	25,000	loads of dust	6187	"	4	11·4	"
	70,000 loads.		13,937	"	4	0	"

From the foregoing estimates, the extreme difficulty of dealing with street and house-refuse of a *Huge Wen*, as the Metropolis has been aptly styled, on a commercial basis, or in any financial sense of making both ends meet, must become apparent. "Slop" and "dust" are not so acutely noxious as sewage, which has been described by Sir Joseph Bazalgette as "an enemy to be got rid of as quickly as possible." They are nevertheless persistently produced in

the ordinary course of civilized nature, and must, like sewage, be got rid of, an imperative necessity, which overrules considerations of simple finance.

Manipulation of Refuse. Islington Washing Process.

The Islington Washing Process, already briefly alluded to, is in operation in one of the yards of the Islington vestry at Holloway. The Wash Mill is a medium for washing the slop and macadam-sweepings, as in a pug-mill, agitated by revolving stirrers. The liquid is subsequently poured on carefully prepared filter-beds, from which the water is passed off perfectly clear and free from the mud, which is left as a deposit on the surface of the filter-bed, whilst the sand and stones are left behind at the bottom of the mill. This mill is worked by two horses. About 35 cubic yards of macadam slop is washed per day; producing about 14½ cubic yards of sand, and 3½ cubic yards of stones, at a cost estimated at 1*s.* 3½*d.* per cubic yard. The selling price in 1880 was 2*s.* 6*d.* per cubic yard for sand, and 6*s.* per cubic yard for stones, showing considerable margins of profit on the cost of washing. The mud refuse has a saleable value of 8*d.* per ton. It is of the nature of a very rich loamy sand, especially when mixed with burnt "dust," or burnt "hard-core" from the ashpits. The Islington vestry are to a large extent their own customers, as much of the manipulated products are made available for road-making.

A large washing machine, 36 feet in diameter, is also at work in a brick-yard, at White Hart Lane, on the Great Eastern Railway. It is driven by steam power, and it washes daily about 200 tons of chalk and brick earth.

Since 1880, the washing process has been carried on upon a more extended scale; about 125 cubic yards of slop is now washed per day, by means of three washing mills driven by a 12-horse-power steam-engine. The produce

consists of 22 cubic yards of sand and ballast, of which the sand is sold for 3*s.* per cubic yard, and the ballast for 4*s.* The work as carried on results in the net loss of 2¼*d.* per cubic yard; but as the cost to the vestry by the previous system of disposing of the slop is stated to have been 1*s.* per yard, relatively, a saving of 9¾*d.* per cubic yard would appear to have been effected.

NEWINGTON PROCESS.

The Newington process of manipulating town-refuse, by which an artificial manure called "Newington mixture" is manufactured, bore the reputation of being the only system hitherto adopted in London that completely covers the entire annual outlay for scavenging. The vestry of St. Mary, Newington, has a receiving depôt, about 1¾ acres in area, adjacent to the railway, where breeze and ashes are manufactured, the railway arches being utilized for stables and stores. At the rear there is a large paved yard, constructed with gutter-drains, on which temporary banks are made in the shape of a hollow square of stable manure and soft core from the dust. Into this hollow square or temporary tank the slop and road-sweepings are shot from the carts as they are brought into the yard, until the tank is about half-filled. The water is allowed to drain off for six or eight days; after which the temporary tank is filled up with stable-manure mixed with soft core, and the whole is turned over, loaded into the railway waggons and conveyed to the country depôts, whence it is carted away by farmers, who, in 1880, paid 3*s.* per ton for the material in summer, and 2*s.* 9*d.* in winter. In Newington the proportion of paved to macadam carriage-ways is below the average, there being only 3¾ miles of the former to 27⅞ miles of the latter, in the ratio of about 1 to 7¼.

There appeared, in 1880, to be hardly sufficient data for ascertaining the exact cost per ton of manufacturing the Newington mixture. It was stated that the entire cost of the depôt preparation and freight by railway was covered

by the proceeds of the sale of this mixture, with that of breeze and ashes; whereas the cost of removing the refuse under contract, before the introduction of this system, was between £3000 and £4000 per annum for the removal of dust and slop.

Now, in 1884, Newington continues to dispose of its refuse manipulated on the same system. It has been found necessary to establish depôts in the country for surplus manure, one at Langfield and another at Meopham, at a cost of £4000. By the establishment of these depôts the vestry has been enabled to secure better prices for the manure—3*s.* 6*d.* per ton for nine months in the year, and 3*s.* per ton for three months. Orders are now booked three months in advance. It is alleged that the introduction of the treatment has resulted in a relative saving to the vestry of £27,000 in the course of ten years, although, according to the annexed estimates * for the financial year 1884–5, there would seem to be an actual excess of about £800 of expenditure over receipts.

The principal conditions for the successful practice of the Newington system would appear to be these:—

1. Cheap carriage from and to convenient depôts.

2. Poor stiff agricultural land for treatment easily accessible.

3. A moderate price for the mixture.

4. Scarcity and uncertainty in the supply of stable and other manures.

The results of the use of the Newington mixture in farming operations are stated to be very satisfactory. It is alleged that poor land in Kent, let at an annual rental of only 12*s.* per acre, has been made to yield, when treated with the Newington mixture, better crops than richer land commanding an annual rental of £5 per acre farmed in the ordinary way.

It is further stated that farmers using the mixture have been very successful in securing prizes for the produce at agricultural shows.

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* See pp. 426, 427.

DEPÔT DE

STATEMENT SHOWING PROBABLE RECEIPTS AND EXPENDITURE
AFTER BEING DEPOSITED IN THE DEPÔT,

CR.	£.	s.	d.
Estimated amount to be realised by sale of 12,000 tons of mixture (summer supply), at 3*s*. 6*d*.	2100	0	0
Estimated amount to be realised by sale of 5000 tons of mixture (winter supply), at 3*s*. 3*d*.	812	10	0
Estimated amount to be realised by sale of 4000 tons of mixture (winter supply), at 3*s*.	600	0	0
Estimated amount to be realised by sale of 11,500 tons of ashes and breeze, at 4*s*.	2300	0	0
For removal of trade refuse	20	0	0
Meopham Depôt (surplus land)	5	0	0
*Balance against	803	17	11
	6641	7	11

NOTE.

Aggregate of Mixture.

Summer supply	12,000
Winter supply	5000
" "	4000
	21,000 tons.

* This balance is £47 8*s*. 9*d*. less than that of the preceding

'MENT.

IDING THE DISPOSAL OF ROAD SWEEPINGS AND HOUSE DUST,
'HE YEAR ENDING LADY-DAY, 1885.

DR.	£.	s.	d.
ding, mixing, and loading 21,000 tons of mixture, at 4*d.* .	350	0	0
; dust, 13,500 loads, at 11*d.*	618	15	0
ng ashes and breeze, 11,500 tons, at 3*d.*	143	15	0
s employed in loading (3⅓)	166	13	4
ay carriage of 21,000 tons of mixture, at 1*s.* 8*d.*	1750	0	0
Do. on 11,500 tons of ashes and breeze, at 1*s.* 8*d.* .	958	6	8
Do. for hard core to shoot, 1500 tons, at 1*s.* 8*d.*, includ-ıg loading	125	0	0
ay carriage for old mats to depôt, 200 tons, at 1*s.* 8*d.* . .	16	13	4
ng 1500 tons of hard core, at 3*d.*, and unloading at Longfield, t 2*s.* 3*d.* per truck	39	11	3
ng 200 tons of old mats, at 4*d.*, and unloading and burning t Longfield, at 2*s.* per truck	7	6	8
ıission on sales, and incidental expenses, 32,500 tons, at 3*d.* .	406	5	0
: dung, 750 horses, at 2*d.* per horse per week . . .	325	0	0
)o. 150 horses, at 1½*d.*	48	15	0
)o. collection of 8000 loads, at 9*d.* per load . . .	300	0	0
)o. for horse hire, collecting (2⅔)	133	6	8
s of driver and men attending the lift, cleaning well, &c. .	325	0	0
' of vestry clerk for supervision of town and country depôts .	100	0	0
' of vestry clerk's assistant, including railway pass . .	146	0	0
' of superintendent (one-half)	75	0	0
ibution towards wages of shunter	20	0	0
tising sale of mixture and ashes	26	0	0
of Meopham Depôt	15	0	0
coke, and firewood	145	0	0
: (one-third)	25	0	0
›ne-fourth)	25	0	0
ıcking, boiler composition, &c.	35	0	0
'ectants	30	0	0
ls, dust baskets, sieves, &c.	50	0	0
rs to machinery	25	0	0
brooms, &c.	10	0	0
ıgencies	200	0	0
	£6641	7	11

:, notwithstanding an increased expenditure of £860 1*s.* 3*d.*

CITY OF LONDON. LETT'S WHARF.

The refuse of the CITY OF LONDON is of a more varied description than that of the metropolitan parishes generally, and receives systematic treatment at Lett's Wharf, on the southern side of the river near to Waterloo Bridge, about 1090 yards from the northern end of Blackfriars Bridge, and 2658 yards from Guildhall, about the centre of the City area. It was first used by the Commissioners of Sewers in 1869, but it had been for a long period used as a scavenger's depôt. In 1875, the Commission purchased a thirty-four years' lease of the property, and, from the plans of Colonel Haywood, rearranged the entire area for the disposal of the City refuse. The area is about 9000 square yards; there is a river frontage of 209 feet, a jetty projecting 98 feet from the river-wall, and the use of two draw-docks. Five barges can lie alongside the jetty and wharf frontages at the same time. There are two good cart-entrances to the wharf from Commercial Road, stables and workshops, sheds, living-rooms, and various other structures have been built at a large cost. They were sufficiently advanced to be occupied in December, 1876. The stabling, for seventy-two horses, was divided into four compartments, each capable of accommodating eighteen horses; the space between the stables is a yard covered with a glass roof, so that horses can be groomed in all seasons under cover. Over the stables are lofts for the storage of hay and corn, a room for general stores, another for storing and repairing harness, a chaff store, and a chaff-cutting room, with steam-engine and machinery for cutting and cleaning the chaff, mixing it with corn, and delivering it at the level of the stables for consumption.

On the eastern side of the stabling, separated from it by a roadway twenty feet wide, there is a range of buildings, comprising stabling with five loose-boxes and means for mashing and steaming food, and applying hot and cold water to sick horses; a blacksmith's forge, a boiler-house for supplying steam to the chaff-cuttting machine, a

scavengers' mess-room; a kitchen for the cooking of food, and a chamber heated by steam for drying clothes, horse-cloths, and other conveniences.

Nearer to the river, and close to those parts of the wharf upon which dust and ashes are deposited, there are rooms for the accommodation of the hands employed in the dust-yard, those for the men being on the eastern side, those for the women on the western side of the wharf. On each side of the wharf is a store for rags, paper, iron and other materials, products of the manipulation of the "Dust."

Near the river there is a furnace, with a shaft 120 feet high, for consuming old baskets, matting and like materials.

The refuse of the City of London is classified by Colonel Haywood under five heads.

1. House-refuse.
2. Trade-refuse.
3. Market-refuse (both animal and vegetable).
4. Street-sweepings.
5. Condemned meat.

All of these, with the exception of the 5th item, are conveyed to Lett's Wharf—the meat condemned by the Medical Officer of Health being sent to, and treated at another place.

House-refuse consists mainly of ashes, cinders, paper, rags, broken crockery, bones, a small quantity of vegetable matter, at times small quantities of human excreta, mixed with the ashes removed from the houses inhabited by the poor, in the few obscure courts and places still remaining in the City area.

Trade-refuse consists largely of coarse paper, string, straw, wood-shavings, sawdust, and various grasses used for packing goods and fruit. It comprises also engine-ashes, clinker, broken stoneware, broken glass, and brick rubbish, The refuse from fruiterers, eating-houses, and taverns, and fishmongers, is more or less in a wet state, generally mixed with considerable quantities of sawdust, and much of it

may be classed with market-refuse. There is also a considerable quantity of spoiled tinned food.

Market-refuse is the animal and vegetable matter removed from the several markets, with similar refuse from fishmongers and others already mentioned. Many tons per week of bad shell-fish and wet fish are carted from Billingsgate Market to Lett's Wharf.

Street-sweepings are the materials removed from the public ways, consisting largely of horse-droppings, with hay, straw, fragments of packing materials, and other waste materials incident to the enormous trade and traffic. They include also the dust and litter illegally swept on the surface of the public ways out of shops, and deposits from the catchpits of gullies.

Condemned meat is first spoilt by immersion in a bath of chemical fluids, so as to render impossible its use for human food. The bath is in a separate building near to the Metropolitan Meat Market. The spoilt meat is sold to contractors, and is delivered at their yards by the Commissioners partly to Bow and partly to Belle Isle. The quantity of condemned meat amounted in 1880 to 273 tons, which was sold for £870.

The quantity of refuse from the City of London delivered at Lett's Wharf, increased from 50,054 loads in 1871 to 61,239 loads in 1880. The carts or vans vary from 1½ to 2 cubic yards in capacity; they are not always filled, and it is estimated that a load represents the average of one ton weight. The refuse removed in 1880 was:

	Loads.
House, trade and market refuse . . .	31,161
Street sweepings and slop . . .	30,078
Total loads	61,239

The stated number of loads of street-sweepings and slop does not appear to include the deposits taken from the gullies and sewers. These quantities may be taken at per mile of way (48 miles), and per day, for comparison with

the general averages for the Metropolis given at page 19, as follows:

CITY OF LONDON, 1880.

Refuse.	Total for the Year.	Per Mile of Way.	Per Mile per Day.
	cubic yards.	cubic yards.	cubic yards.
Slop and street-sweepings . . .	30,078	627	1·72
House, trade, and market refuse .	31,161	649	1·78
Together	61,239	1276	3·50

The house, trade, and market-refuse together, equal the slop and street-sweepings. The total refuse is generated at the rate of 3½ cubic yards per mile of street per day, as compared with 2 cubic yards for the Metropolis as a whole.

When the "dust" carts arrive at the wharf, their contents are tipped into heaps at the places most convenient for the people who are employed as sorters. Some 70 persons, chiefly women, are engaged in this work. Most of these are paid piece-work, but 16 female sifters receive 7 shillings and a little coal and wood weekly. Standing in the midst of fine dust piled up to their waists, with face and upper extremities begrimed with refuse, they are surrounded by and breathe a foul, moist, warm atmosphere.

The dust is placed in large circular sieves, which are worked by the sifters, and divided by the process into two portions, the finer of which falls at the feet of the operators, partly burying them, and the coarser, which is thrown on one side for the next process. This is the separation and sorting of the various articles, all of which have a certain commercial value, such as clinkers, bottles, old metal, crockery, paper, corks, bones, rags, string and so on, which are carefully placed in distinctive heaps for sale. The sifters and sorters are employed by a general contractor, who is paid by the Commissioners some 9*d.* per load, the contractor taking as well the paper, whole bottles, rags,

iron, tin, etc., leaving to the Commissioners the breeze, soft core, and useless hard core (worn-out pots and pans and large articles). This payment of 9*d.* a load amounts to from £20 to £25 per week. The following are some of the more constant products, with the approximate market values attached :

Scraps of iron . . .	25*s.* to 30*s.* per ton.
Rags	20*s.* "
Bones	50*s.* "
Iron	20*s.* "
Metal	18*s.* per cwt.
Tin ware	3*s.* per cart load.
Corks	1*s.* per bushel.
Bottles (whole) . . .	9*d.* per gross.

It is generally understood that "crinoline steel" is about the only article found among the refuse that can neither be utilized, converted, or easily destroyed.

Barges are loaded with the "breeze" and "ashes" in the proportion of 1 to 2, and sold to brick-makers. A barge load varies from 60 to 70 chaldrons. The hard core (clinkers, broken bottles and crockery) is used for road-making.

The value of breeze and ashes varies; latterly it was from 2*s.* to 2*s.* 6*d.* per chaldron. The Commissioners have frequently to pay 50*s.* a barge-load for the removal of the hard core. About one barge-load per week is thus disposed of.

The expenses incurred in the work comprise charges for

A general manager and salesman at £225 per year;

A gauger at 50*s.* per week;

Twelve men at 5*d.* per hour, day work, or 3*d.* per chaldron for stuff shot into barges;

A lighterman, to look after the barges and berth them, at 35*s.* per week, with a house;

A furnace man at 4*d.* per hour, 10 hours a day.

These charges are irrespective of the general staff of the yard and those employed outside its walls.

The horse-manure collected by the street-orderly boys in the highways of the City of London, and brought to

Lett's Wharf, is mixed, upon a platform on the open wharf, with soft core, slop, offal, and decaying fish, &c. The mixture is sold at certain seasons to farmers at £2 per barge-load of 40 tons. The reason offered for this extraordinary and apparently unthrifty sophistication is that it facilitates the disposal of malodorous material, for which, in its offensive integrity, there would be no direct market.

The ordinary street-sweepings or mud are disposed of in conjunction with animal and vegetable refuse. Market-refuse is, when collected, at once mixed with the sweepings when they are dry or nearly so, and shot from the carts into barges which are always lying ready, and daily leave the wharf with this mixed material. It is but rarely that any offensive matter remains at the wharf twenty-four hours.

Street-sweepings, when in large quantities in the condition of very diluted slop, are not at all times shot directly into the barges; but occasionally deposited on the wharf, temporarily mixed with straw litter and dry material. Water rapidly drains away, and the residue is mixed with the dry sweepings, stable manure, or other drier matters having manurial value, and cast into the barges.

Materials liable to decompose or become offensive are not removed from the wharf through the public streets; old iron, tin, lead, glass, leather, paper, and other hard materials alone being carted away. Nearly all this refuse material is sold, some being almost given away, and it is only at rare times that the Commission has to pay for getting rid of the material not burnt up. In the furnace are destroyed all baskets, matting, shavings, and other refuse which would be injurious to the sale of the street-sweepings and market-refuse, if mixed with them.

The refuse thus sorted and sifted commands a steady sale, the proceeds of which, after covering the cost of sorting, sifting, and removal, leave a balance of gain over the expenditure. The following return, compiled by Colonel Haywood, shows what has been obtained by the sale of the refuse delivered at the wharf, and the expense

incurred in manipulating and disposing of it, for a period of four years :—

REPORT OF THE CITY OF LONDON. SALES.

Year.	Receipts.									Expenditure in Sorting, Sifting and Removal.			Balance Receipts over Expenditure.		
	Sale of Manure.			Sale of Ashes and selected Materials.			Total.								
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1876–77	2416	16	4	3147	7	0	5564	3	4	3197	15	9	2366	7	7
1877–78	2245	6	0	4247	17	6	6493	3	6	3597	10	2	2895	13	4
1878–79	1999	17	0	4376	19	3	6376	16	3	3338	5	5	3038	10	10
1879–80	1015	0	0	2575	17	9	3590	17	9	3114	1	9	476	16	0
Average for 4 years, 1877–1880.	1919	4	10	3587	0	4	5506	5	2	3311	18	3	2194	6	11

None of the cost of collection in the City, or cartage to the wharf, of the material, is included under the head of expenditure in this table ; but the delivery on the wharf and the shipping are included.

Large works for the destruction of the refuse of the City of London, on Fryer's principle, are now in course of erection at Lett's Wharf. An account of these works will be given in continuation of a general account of Fryer's system further on.

MANURE COLLECTED BY STREET ORDERLIES.

It is greatly to be regretted that the material collected by the street-orderlies is not more carefully treated and kept separate and unadulterated, so as to induce some enterprising agriculturists to turn attention to the utilization of the peculiar fertilizing qualities it must possess. The supply would be sufficient for the production of practically unlimited quantities of Mushrooms, Scotch bonnets, and Champignons, for which there would always be unlimited demand.

The result might be as—if not much more—important to the agricultural interest as the suggested cultivation of fruit for conversion to jam.

PROVINCIAL CITIES.

In the provincial cities, local conditions are materially different from those that "shape the course" of metropolitan authorities.

For towns which are situated on the coast, as Liverpool, such portions of the "dust" as after manipulation can be disposed of at a price,—iron, rags, glass for instance—are utilized, the stable-manure is sold, and the residuum is simply tipped into a steam hopper-barge, and taken to sea.

In inland towns that have no convenient outlet for water-carried sewage, and consequently adopt the "Pail system," the night-soil is usually worked into the dust and street-sweepings, to form artificial manure. This treatment has obtained principally in connection with the Rochdale Tub System, adopted in 1870; but it has been introduced at Manchester and Salford, and it had been employed in other forms for many years in Birmingham and other inland towns in the north.

The Goux process has been extensively combined with the Pail system. In the Goux process, animal, vegetable and fibrous matters are mixed with sulphate of iron, or sulphate of lime; and are made available in a manner somewhat similar to that adopted with Moule's earth-closet system. It has been practised in Sheffield, Salford, Aldershot camp, and Halifax; and extensively in the rural districts in the counties of Rutland, Buckingham, and Leicester.

From the evidence presented in the foregoing pages, it may be concluded that the principle of self-supporting industry, or of bringing about a balance at least of expenses and receipts, can find no considerable place in dealing with the question of the treatment and disposition of town-refuse. It

has been found practicable in some cases to cover the cost of sifting and sorting house-refuse, by the proceeds of the sale of the classified articles. But these items do not bulk largely in the gross account, and the consideration of the best mode of dealing with the "refuse" of large and populous communities must be approached in a truly liberal and large-minded, far-seeing, catholic spirit—a spirit that will renounce "rigid economy" as parsimonious extravagance, and regard judicious and generous expenditure as true and genuine thrift, although the immediate estimated returns may not be regarded as satisfactory, viewed in the light of "dividend."

UTILIZATION OF STREET AND HOUSE REFUSE IN CONNECTION WITH SEWAGE.

"DIRT is matter in the wrong place,"—such was the epigrammatic dictum of Lord Palmerston some 30 years or more since. He was a Statesman who would not have hesitated to recommend the adoption of an extensive and well-considered plan for the removal of the fortuitous concourse of atoms from the wrong to a right place when the operation was of a nature widely and permanently to benefit his country, even if the process were not directly lucriferous—so as to eventuate in 5 per cent. per annum, or in a return immediately equivalent to 20*s.* to a £.

The reconversion of sewage into the profitable primary elements of which it is composed, remains a problem not yet satisfactorily solved. Many modes of treatment have been advanced, advocated, and essayed; but a comprehensive solution of the problem yet awaits adoption. Meanwhile the rivers and streams in this country are contaminated and poisoned by discharge from water-closets, which, however effective as a means of easily removing animal excreta from the dwelling-house, are as mischievously effective in lodging it where its presence should only be tolerated under protest. Intercepting sewers as a necessity followed the introduction of the water-closet system, in the Metropolis. The cost of the system startled the Metropolitan Board of Works a quarter of a century ago, and now the necessity for the extension of the main drainage lower down the river is becoming more and more urgent and apparent, and whilst there is yet time for the development of a matured, comprehensive scheme of extension, it

is worthy of consideration whether a system of transport and deposition, on some extensive area of waste lands, of the street and house refuse, in combination with the discharge of the Metropolitan sewage, might not be effected with advantage ; the former by railway, the latter by culverts. There is at hand a scheme, brought forward in 1864, that of Messrs. Napier, Heenans, and Hope, for conveying the discharge of the section of the Metropolis north of the Thames to the Maplin Sands on the Essex coast. The dry-weather sewage was taken at 10 millions of cubic feet per day, subject of course to material increase. The main culvert for the extension was designed to start from Abbey Mills, three miles from London, with a duplicate section or branch from the Barking reservoir. These two culverts were to be united at a distance of 6 miles from Abbey Mills, and to be 10 feet in diameter for a length of 38 miles, to the head of the navigation of the river Crouch at Battle Bridge, the sewage following by gravitation to the sea. At the 28th mile, the conduit was to be again divided, the one branch leading towards the Maplin or Foulness Sands, and the other towards the Dengie Flats. The total distance from the Abbey Mills to the Maplin Sands is 44 miles. The scheme contemplated the reclamation of 7500 acres on the Maplin Sands and 4500 on the Dengie Flats, making together 12,000 acres. The estimated cost of culverts, pumping stations, and reclamation embankments and contingencies was £2,100,000, with an annual cost of £10,000 for pumping. The total expense of carrying the sewage from Abbey Mills to the sea, including 5 per cent. on the cost of the culverts, but exclusive of sea-embankments, was estimated not to exceed one-fifth of a penny per ton.

In connection with some such scheme as this, arrangements might be designed and organized for the conveyance of all the house and street refuse of the Metropolis, by and on a line or lines of railway constructed more or less in combination with the culvert running alongside or upon it. The cost of such railway double line, say 50 miles in length, at

the rate of £20,000 per mile, would amount to £1,000,000. It was estimated that the house and street refuse amounted in round numbers to 1¼ millions loads or tons for the year 1878, say 1½ millions for 1884, equivalent to 4110 per day. If carried in 10-ton waggons, in trains of 40 waggons, making a train load of 400 tons of stuff, ten train loads per day would be taken to the seaside. Allowing for returning, empty waggons, and for waggons loading, unloading and spare, a stock of, say, 3000 waggons would be necessary, with 30 locomotives and tenders. The estimated approximate cost for way, works, terminal accommodation, and rolling stock, may be taken as follows:—

Way and works	£1,000,000
Terminal accommodation loading banks .	120,000
Rolling stock	400,000
	£1,520,000

Taken together, the estimated approximate capital cost of the combined scheme of transporting sewage and refuse to the Maplin Sands would amount to £3,620,000.

The solid refuse discharged on the flats might be saturated to any required extent with sewage, from which much of manurial value would be absorbed by the solid matter, whilst the surplus (filtered) fluid would be allowed to flow into the sea. The sewage would be vastly in excess of the solid refuse in point of volume. Such of the sewage as would not be required for saturating more or less the mass of house and street refuse, could safely be left to diffuse over those vast waste areas, and to deposit suspended matter before finally escaping into the sea. In course of time extensive grass-lands would be created, which, judging from the long-tested precedent of the Craigentinny meadows, near Edinburgh, and the more recent example of the Salt Water Lakes, Calcutta (crude though this example may seem to be), might fairly be expected to produce valuable and continuous crops of grass and other products—eventually the Cerealia.

It is not suggested that any such a comprehensive and gigantic project could be undertaken by private enterprise, or that it would be a "paying concern." It is merely an outline of a suggestion of how "refuse,"—much of it offensive in its nature—might be dealt with *en masse*, and converted to useful purpose.

If it be true that "the man who makes two blades of grass grow in place of one is a benefactor to his country"—the community that converts 12,000 acres of waste land into productive pasture, or arable, would be equally praiseworthy to a proportionate extent, by *creating* so many acres of the richest alluvial soil.

The matter must be considered from a much higher point of view than that of mere grovelling—commercial profit and loss.

Whatever the outlay might be, the whole would be expended in the employment of labour without even an infinitesimal fraction of the eleemosynary element, and without diminishing by so much as a single farthing the available wealth of the country. The expenditure of a million or two in the employment of labour to the East of London, extending over a few years, would not be injudicious even if a generation were to pass away before the 12,000 acres were all a smiling plain, and the 12,000 acres of productive land would be an appreciable addition to the available Wealth of the Nation.

A generation is but a fraction of the life of a Nation, and the beneficial results of such a work would last as long as the Nation itself.

Maplin Sands do not afford the solitary instance of extensive waste lands within reasonable distance of the Metropolis, and other large aggregations of "refuse-producing" populations. The conditions of each vary, each would require different treatment and varied works; in one particular all would be similar, that the greater part—if not indeed the whole—of the expenditure would be in the employment of labour, and none of that outlay would be lost to the Nation.

Utilization by Destruction and Conversion.

Disregarding matters of detail, it becomes manifest that in many cases the ultimate solution is to be found in treating "refuse" as "the enemy to be got rid of"—in a mode somewhat analogous to the line of treatment that has been applied to sewage. It must be treated in the mass, in this case not with water, but subjected to the action of that all-decomposing and all-purifying element, fire. Cremation had been partially and tentatively employed at the furnace at Lett's Wharf, and elsewhere. But the dispositions for dealing with and sorting the mass of refuse in detail had been generally little more than elaborate trifling, and had often generated inevitable nuisance. It is, however, with some satisfaction that attention can be directed and consideration given to some such comprehensive system of treatment by Cremation and Carbonisation as that which has been practically applied by Mr. Alfred Fryer, of Nottingham, by means of specially-designed furnaces.

The system involves two processes.

1. The Destruction by fire of everything combustible in house and trade refuse, with the incineration of sundry mineral matter.

2. The separation of the vegetable from the animal and mineral matters, and its Conversion into charcoal.

The first process is effected in an apparatus or structure called a *Destructor ;* the second in a structure or apparatus called a *Carbonizer*. The system is in operation at Leeds, Bradford, Warrington and Manchester.

Fryer's Destructor and Carbonizer.

The Destructor is defined by Mr. Fryer, as "a form of furnace designed for the reduction by fire of substances that contain only a small portion of combustible material. As erected at Armley Road, Leeds, it represents externally

a cubical mass of brickwork, about 22 feet wide by 24 feet deep and 12 feet in height, all well tied and bolted together with strong iron rods, which perforate the whole structure.

The top forms a perfectly flat platform, having an opening about 3 feet square over each cell, into which the refuse to be burnt is shot directly from the collecting carts. An oval-shaped service hole of larger dimensions is provided for the admission and destruction of infected beds, mattresses, bedding, and other bulky articles. In direct continuity with this platform, is an inclined roadway, up which the carts laden with refuse travel. This need only be of sufficient width to enable carts to pass on their journeys up and down the incline. It terminates at the upper end in a level portion, about 3 or 4 feet higher than the top of the Destructor, so that the carts can back to and against a strong wooden baulk, or curb, and shoot their contents directly on to the mouths, or feeding inlets of the furnaces, without any further manipulation than the act of tipping or tilting. In this way an enormous amount of labour is saved, and the nuisance created by any process of sifting and sorting altogether prevented.

Internally the Destructor consists of a double set of three cells placed back to back, or in all 6 compartments, each of which is in direct communication with a tall chimney shaft. A cell, therefore, constitutes a separate furnace, being a cavity enclosed by a reverbatory arch, both being lined with fire-bricks. The cell is supplied with a hearth for the reception of the material to be consumed, from which it passes into the furnace proper; the fire-bars are placed in an acutely slanting position, in order to facilitate the passage of the heavier and indestructible portions of the refuse downwards to the front-doors, for the more easy removal of clinkers. These fire-bars are ingeniously made, representing in section an isosceles triangle, the base of which is placed upwards, so that when the burning refuse becomes sufficiently comminuted to pass through between the upper

faces of the bars, the small ash falls into the receptacle below, and all chance of choking, the effect of which would be to diminish the draught, is obviated. These fire-bars are durable. At Armley Road they lasted more than 14 months, during which time over 15,000 tons of refuse had been burnt. Each cell has two openings in the reverbatory arch which correspond with the back end of the furnace. One of these is for the admission of the refuse as above described, and the other for the escape of the gaseous products of combustion into the flue. Between these openings is a brick wall, which constitutes a diaphragm which prevents the refuse as well as the gases having access to the flue. Each cell is also provided with an ordinary furnace frame and doors, of which the latter are required for two purposes—to start the furnace with fuel when commencing operations, and for the extraction, from time to time, of metallic articles (from a tea-kettle to a sardine box), and the clinkers which result from the burning refuse, containing every conceivable kind of indestructible waste. When the furnaces are in full work and constant operation the clinkers require to be withdrawn every two hours, and at about the same interval the attendant on the top of the Destructor shovels in a fresh charge.

One man suffices to feed six cells for the day working, but two are required for the night shift, most of the refuse being delivered after sunset. Each cell will consume seven tons of refuse in twenty-four hours ; so that a Destructor containing six compartments suffices to consume 13,104 tons in fifty-two weeks of six working days.

A large quantity of superfluous heat necessarily results from the process, since the caloric is radiated from the reverbatory arch on to the burning material. The hot gases thus generated can be utilized on their way to the chimney shaft, and made to raise steam in a multitubular boiler of 6 feet in diameter and 10 feet in length, driving power being created at a pressure of 40 pounds to the square inch, and a temperature of 287·1° Fahrt. found to be equal to

working two powerful mortar mills, with pans of 8 feet in diameter, by means of a horizontal engine of 14-horse-power with 12-inch cylinder and 2 feet stroke. It is alleged that the steam might be employed for concentrating liquid (in vacuo), however offensive, without the escape of any perceptible smell. It would be tedious and indeed unnecessary to enumerate or suggest the various purposes to which this vast motive agent could be applied in establishments of magnitude, an agent, be it remembered, obtained without expense after the first cost of boiler and gearing has been incurred.

The chimney shaft in connection with the Destructor forms a very important adjunct, and should be of sufficient height to prevent fine particles of dust being distributed over the neighbourhood. The chimney at Armley Road is 126 feet high, at Manchester it is 160 feet, at Bradford it is 180 feet high, at Birmingham it was originally 120 feet only, but it was found necessary to raise it to 170 feet, which height remedied all objections, and had the effect of materially increasing the power of the Destructor. Dust does not escape from the chimney, provided that the flues are large enough, and are not allowed to become choked with dust. They are made large in order to moderate the velocity of the current, and encourage the deposition of the dust, to be from time to time removed. By means of the Destructor the reduction of mixed matter is effected to the extent of from four-fifths to six-sevenths; where six or seven loads of material more or less offensive had previously to be boated or carted away, only one load desiccated and inoffensive to be removed.

The formidable mass of vegetable refuse and garbage remains however to be treated by heat. Subjected to a high temperature in the "Carbonizer," these matters are in a manner distilled, the elementary gases, oxygen, hydrogen and nitrogen are driven off, and the solid residuum is charcoal.

The Carbonizer which is erected at Burmantofts consists of a group of vertical brickwork cells and furnaces,

each cell having its own special furnace alongside. The structure is 26 feet long, 12 feet wide, and $15\frac{1}{2}$ feet high, braced with iron rods and angle irons. The refuse to be carbonized is fed into each cell from the top. It is slowly carbonized as it descends, and the products—vegetable and animal charcoal—are withdrawn at the bottom. The interior of each cell is fitted with a series of alternating inclined or baffle plates of cast iron, which project from the walls of the cell, overlapping each other, and act as inclined planes, on which the matters slide downwards as consumed from one to another. The baffle plates are arranged in helical order, inducing a winding direction for the descent of the matters, by which they are turned over at each plate. The products of combustion of the fuel in the furnace—usually breeze—are conducted upwards, in the winding flue, underneath the baffle plates, passing laterally from under each plate, into the space under or behind the next plate above it. The plates, of course, become highly heated, and in that condition calorify, dry and ultimately carbonize the matters resting over them, which attain to red heat, as they arrive at the lower part of the cell—a chamber of red-hot firebrick. The charcoal which arrives at the hearth is withdrawn, at intervals of three hours, into a small truck, in which it is removed. The superincumbent mass sinks from plate to plate, and as it sinks it is exposed in its turn to the gradually augmenting temperature.

Air is not admitted to the cell during the process of charring. It is essential for the purpose that air should not be admitted. If it were allowed to enter, the charcoal would be consumed, contrary to the intention of the design of the Carbonizer, that being the production of charcoal bearing an appreciable market value.

The heated gases pass out of the cell through an opening near the top into a descending flue, from the lower part of which they are conducted by a horizontal flue to the chimney shaft. By this disposition of flues, economy of heat is maintained, as whilst the less heated portions of the gases have a tendency to descend, the more heated por-

tions, on the contrary, tend to remain in the upper part of the descending flue.

The charcoal is red-hot as it is drawn from the cell, and is cooled in a charcoal cooler, by being passed through a revolving cylinder, over which cold water is continually streaming. It is sifted as it issues from the furnaces cylinder.

Each cell is capable of carbonizing $2\frac{1}{2}$ tons of refuse in the course of twenty-four hours. The fuel required for the furnaces is sifted from the refuse of dry ashpits.

AT LEEDS.

Armley Road Station, the Destructor at which has above been described, is one of two stations at which the Corporation of Leeds carries on the process of burning refuse. It is situated in the town of Leeds, not more than a mile west of the centre of the town, in the midst of a dense population, surrounded by houses and shops of a respectable character. The refuse of about 60,000 persons is treated at this station. It was built in the year 1880, and has been in full operation since October of that year. The materials dealt with include house dust, street-sweepings, market refuse, and human excrement from middens, the pail system being in use in many parts of this district.

No offence is experienced in the vicinity of the depôts. The place is entirely free from smell, and although night soil in large quantities is mixed with the house refuse it is completely deodorized by the carbonaceous matter in the cinders.

Dr. W. Sedgewick Saunders, Medical Officer of Health for the City of London, describes the results of an official examination at Armley Road Station. "We saw the men," he says, "delivering large masses of refuse, including house dust, market refuse, and paved street sweepings, night soil from middens, &c., on the top of the Destructor; then watched the gradual sinking of the stuff into the

service holes, as the portions below were consumed; following this down to the front, we witnessed the extraction of the coarser materials (pots, pans, glass, crockery, &c.,) as well as the clinkers from the furnace doors below, the opening of which gave pretty hot evidence of the power expended in the cremation, without a grain of other fuel than that contained in the refuse itself; but the crucial test of all was when the smoke box, at the end of the boiler, through which all the fumes pass onwards to the chimney shaft, was opened, there was not the least odour, so completely had all organic matter been dissipated in the furnace. Again, when the clinkers and molten metal and glass, all fused together, were drawn, the only perceptible smell, and that very faint and momentary, was of a slightly sulphurous nature.

"The fine dust deposited in the flues and carried for some distance up the chimney by the gases and smoke, falls back into the 'dust chamber,' from whence it is removed when necessary and sold to farmers at 2*s.* 6*d.* per load. Large quantities of iron utensils, pots and pans, metal cases, tin, &c., fall to the front, and being raked out, and allowed to cool, sell for from 20*s.* to 30*s.* per ton."

A new commercial product of marketable value has been created by the use of the Destructor; that is the clinker resulting from the process of burning the refuse. It is ground by heavy rolling mills into powder, which when mixed with 25 per cent. of lime and a suitable proportion of water, is converted into a useful mortar or cement, found to be very tenacious and hard, from the oxide of iron and silicious matter derived from the clinkers: small hard bricks are also made from the same material. The making of this mortar costs 4*s.* 5¼*d.* per ton, inclusive of all labour and materials, and sells readily for 5*s.* to 5*s.* 6*d.* per ton; it will keep moist for forty-eight hours, and can be knocked up fresh for use when partially set, like any other mortar. It is valued by local builders, and much sought after. Each mill will turn out about 8 tons of mortar a day.

The other station in Leeds, the Beckett Street Depôt, is in the district of Burmantofts, about two miles from the centre of the borough, in a north-easterly direction. Here the Destructor and Carbonizer furnaces have been in constant operation for the last seven years. According to a report of Mr. Newhouse, the superintendent, in the month of December 1880, 782 loads of rubbish were destroyed at the Beckett Street Depôt, being at the average rate of 34 tons 3 cwt. per day for 25 working days; 31 tons of rubbish were used as fuel for the Carbonizer and 172 tons of market refuse was carbonized.

At the Armley Road Depôt, 1067 loads of rubbish have been destroyed, being an average of 45 tons 3 cwt. per day for 26 working days.

These two stations suffice for the manipulation and disposal of the bulk of the scavengering work of Leeds, covering an area of 21,600 acres, with a population of 326,000.

The following extract from the Report of the Sanitary Committee of the Council of the Borough of Leeds, showing the total cost of the works at Burmantofts, furnishes some useful information:—

"The Committee have fully examined into the cost of the apparatus at Burmantofts, and the quantity of material which has been dealt with, and submit to the Council the following figures and particulars with regard to the matter.

CAPITAL ACCOUNT.

	£	s.	d.
Cost of brickwork, engine, boiler, mortar-mill, destructor cells, carbonizer, and other apparatus and implements; making new road, and providing shed to cover apparatus, etc., etc., at the Burmantofts Depôt	4270	0	0
Royalty to patentee	150	0	0
Value of land and chimney shafts . .	1460	0	0
	£5880	0	0

REVENUE ACCOUNT.

EXPENDITURE.	£	s.	d.	RECEIPTS.	£	s.	d.
To Interest on £5880 at 4 per cent. . .	235	4	0	By Mortar . .	200	0	0
„ Sinking fund .	58	16	0	„ Charcoal .	100	0	0
„ Labour for 12 months . .	627	18	0	„ Scrap iron .	15	0	0
„ Lime . .	40	0	0		315	0	0
„ Depreciation at 5 per cent. covering repairs .	294	0	0	Balance .	990	18	0
„ Gas, water rates, etc. . . .	50	0	0				
	£1305	18	0		£1305	18	0

ESTIMATED QUANTITY OF MATERIAL DELIVERED AT THE DEPÔT.

	Tons.
Rubbish burnt in the Destructor	9923
Used in the Carbonizer for fuel	750
Market refuse	1800
Total	12,473

It will be observed that the net cost of dealing with 12,473 tons of rubbish and refuse delivered at the Burmantofts Depôt has been after the rate of £990 18*s.* per annum.

FOR THE CITY OF LONDON.

It is now understood that the Commissioners of Sewers for the City of London, after long and careful consideration, have decided to adopt Fryer's system of dealing with the refuse of Lett's Wharf, and under the able supervision of their engineer, Colonel Haywood, the works are being carried out by Manlove, Alliott, Fryer & Co., the principal structure being a 10-cell Destructor, of the most

modern and approved construction, with several recent improvements. The furnace doors are made to balance on a wrought-iron shaft, and sufficiently large to allow of the largest clinkers being withdrawn entire, obviating the difficulty of breaking them up within the furnace in presence of the strong heat. The furnace doors are constructed of wrought iron, perforated, to admit air for more free combustion. At each side of the door-frame there are strong panelled castings, by which the frame, deadplate, and fire-bars are supported ; and the brickwork is protected against damage from the large and strong iron wheelbarrows employed to receive and remove clinkers and ash. Cast-iron boxes are built into the front to make room for the balance weights hung to the doors, and the ash-pits are fortified with iron curb-plates. The main flue is of even more enlarged area, to admit of larger deposits of dust, and 14-inch brick walls are carried across in order to break, control and partly baffle the powerful draught, so as to prevent the fine dust being carried up the chimney shaft. The height of the chimney shaft is 150 feet. It is 6 feet in diameter internally, and 16 feet externally at the base, with a lining of fire bricks 30 feet in height, supported by cross walls, and forming a cavity for the circulation of air to prevent the brickwork lining from being too much over-heated. The superfluous heat from the Destructor will be applied to generate steam in a boiler equal to working three mortar mills with pans 8 feet in diameter by means of a horizontal engine of 20 horse-power, having an 18-inch cylinder with a stroke of 3 feet. The steam power will be used also for hoisting the refuse to be consumed, and may further be used for generating electricity, and for cutting hay and other purposes of the depôt. The hoisting machinery consists of two distinct sets of gearing, each of which is calculated respectively to lift the number of loads of refuse required to be treated. In case of breakdown or repairs in progress, the spare gearing can be at once brought into use without interruption of the work. The hoists are driven by separate steam

engines of six horse-power, which are fixed upon a high-level floor situated at one end of the Destructor, immediately underneath the gearing, and directly over the cart-way where the loads of refuse are brought to be lifted. Arrangements are provided by which the hoisting gear may be worked from the same floor, facilitating the control of the whole of the machinery by one attendant. Although the hoisting engines may be worked by steam from the boiler, already referred to as being heated by the superfluous heat from the Destructor, there is provided in addition a small vertical boiler, 10 feet high and 3 feet in diameter, to supply steam for the purpose from time to time on occasion, as at starting, or when it is necessary to burn street sweepings charged with too great an amount of moisture.

The refuse carts will be drawn under the hoist. They are so constructed that, without any other preparation whatever than connection with the lifting tackle, the body of the cart will be released and lifted from the frame and under carriage, leaving them with the horse on the ground. When sufficiently elevated to be placed on a horizontal line of rails laid overhead, the cart-load is hauled horizontally, by automatic gearing, until it arrives directly over the cell which is in readiness to receive the material. The rails consist of strong channel-iron, held by substantial hanger-brackets depending from the trussed wooden beams by which the roof of the main building is supported. The traversing gear is adapted to stop the progress of the load automatically, should the attendant not be present or neglect his duty.

The general buildings will be in correspondence with the handsome elevation of the stables, which have the appearance of a modern factory; while the chimney shaft will be massive and graceful, and will constitute an architectural feature visible from most parts of the Thames Embankment.

The total cost of the Destructor, with the engine, boiler, and mortar mills, is estimated to amount to about £12,000.

WATERING AND WATER SUPPLY.

TO fill a cart with water and then to distribute that water over the surface of a carriage-way is a very easy and very simple operation. When the process has to be applied simultaneously, as near as may be, to a few hundred miles of streets, the operation becomes complicated and less easy.

During a spell of hot weather a practically unlimited supply of water is necessary for the proper maintenance and treatment of public thoroughfares, and where the water supply is in other hands than those of the local authority, difficulties and anomalies invariably present themselves.

In 1852, divers Acts of Parliament were passed, settling or professing to settle the improved and revised conditions upon which water should be supplied by the several then existing companies in the Metropolis for domestic and other purposes, and clauses defining the rates of charges at which water was to be supplied were introduced in those Acts.

Consequent upon the passing of the Metropolis Local Management Act in 1855, the management of the public thoroughfares in many parts of the Metropolis, passed from the hands of Commissioners, theretofore specially appointed for the performance of paving, cleansing, and other duties in certain districts of the Metropolis, into the hands of Vestries and District Boards of Works, whose jurisdiction was defined by the provisions of the Act—Metropolis Local Management, 1855.

Some difficulties arose in reducing to order, and in re-organizing the different and varying arrangements that

had existed under those several Boards of Commissioners,* and it was found that diverse arrangements had been made for so small a matter as watering the streets.

Payment being made by the mile lineal in some cases,—by the square of 100 yards superficial in others,—and by the square yard—pure and simple—in yet other cases.

COST OF WATER.

The rates varied from 5*s.* per 100 square yards for one watering per diem, and 7*s.* 6*d.* per 100 square yards for two waterings per diem, for the "season" extending from Lady-day to Michaelmas-day.

The Companies gave notice during the first season to the newly-installed and inexperienced Vestries and District Boards of their intention to raise the charge from 5*s.* and 7*s.* 6*d.* to 8*s.* 4*d.* and 12*s.* 6*d.* per 100 square yards.

This increased charge was considered by the local authorities to be unwarranted, and they suggested to the Companies that the water should be supplied by meter, as required under the provisions of the several Water Acts.

This the Companies objected to do,—proposed to refer the question to the arbitration of a magistrate,—but after considerable negotiation consented to supply water for road-watering purposes at *not* an increased rate, but at the *reduced* rate of 4*s.* for once watering, and 6*s.* for twice watering per 100 square yards.

This was assented to by the local authorities as a reasonable reduction, for the time being, of the charges previously made. In 1860, the local authorities took further action, by again suggesting the application of the meter clauses of

* In the parish of St. Pancras alone there were no fewer than 17 Boards of Commissioners, exercising independent powers under separate Acts of Parliament. The Vestry exercised jurisdiction over short isolated lengths of carriage-way. There were 7½ miles of carriage-way under the jurisdiction of Turnpike Trustees, and there were four districts under no jurisdiction whatever, "No Man's Lands."

the Companies Acts, and after protracted negotiations the companies undertook to supply *by meter* at a certain fixed rate for every 1000 gallons, with the *addition* of 1½*d.* per 1000 gallons supplied *above* a certain defined height above Trinity high-water mark.

The rate then agreed upon was 1*s.* per 1000 gallons, with sliding scale of discount in the ratio of millions of gallons used; but, in consequence of still further negotiation, this charge has been practically reduced to the uniform rate of 9*d.* per 1000 gallons, at which it now remains.

This charge represents a payment of 2*s.* 3*d.* for one watering, and 5*s.* 1½*d.* for two waterings, per diem, for the season, per square of 100 square yards, as contrasted with 5*s.* and 7*s.* 6*d.* paid in 1856, with the 8*s.* and 12*s.* 6*d.* proposed by the Companies in 1857, and with the 4*s.* and 6*s.* assented to as a compromise in that same year.

When payment for supply of water is made on calculation of the area watered, the agents of the Companies naturally see that none is wasted; they have, or assume to have, a control over the quantity of water distributed by the water-vans, and disputes and misunderstandings occur.

When the supply is by meter the necessity for such supervision and interference, as a matter of course, ceases; a meter being fixed to each stand-post, by which the quantity of water used is gauged and measured for payment—at the cost of the consumer.

The cost of each meter is equal to two guineas per annum, and this adds in a material ratio to the cost of the supply of water.

The statement appended gives the quantity of water supplied from the several stand-posts in St. Pancras during the season 1883, watering being in that year commenced on 6th March and discontinued on 27th September.

It will be seen how various are the quantities drawn from the several stand-posts, although the site of each has been matter of careful consideration, and decided upon as the most advantageous available.

PARISH OF ST. PANCRAS.

DISTRICT SUPPLIED BY THE NEW RIVER COMPANY.

WATER FOR STREET WATERING, SEASON 1883.

Situation of Meter, and Standpost.	Consumption in Gallons.
Caroline Place .	269,000
Lansdowne Place .	255,000
Wakefield Street .	523,000
Gray's Inn Road .	661,000
Britannia Street .	385,000
Euston Road, by King's Cross .	1,056,000
Ditto, Duke's Road	142,000
Euston Square .	1,210,000
Burton Crescent .	825,000
Tavistock Place .	191,000
Endsleigh Street .	83,000
Gower Street . .	71,000
Hampstead Road (Ampthill Square)	630,000
Seymour Street .	354,000
Clarendon Square .	1,105,000
Aldenham Street .	314,000
Pancras Road. .	1,085,000
Bedford Street .	212,000
King Street . .	866,000
Camden Street .	1,034,000
James Street . .	462,000
Delancey Street .	438,000
Buck Street . .	559,000
Chalk Farm Road .	873,000
Victoria Road. .	900,000
College Gardens .	1,149,000
Hammond Street .	589,000
Prince of Wales' Road, by Kentish Town Road . . .	453,000
Grafton Road . .	941,000
Ascham Street .	686,000
Dale Road . .	424,000
Weedington Road .	1,086,000
Prince of Wales' Road (by Almshouses) . .	616,000
Carried forward .	20,447,000

Situation of Meter, and Standpost.	Consumption in Gallons.	Rate per 1000 Gallons.
Brought forward .	20,447,000	
Malden Road . .	1,170,000	
Southampton Road.	567,000	
Mansfield Road .	320,000	
Carkers Lane (by Highgate Road) .	360,000	
Dartmouth Park Road . . .	679,000	
Chester Road . .	325,000	
West Hill, Highgate	60,000 } Hydrants.	
Ditto	37,000 } Hydrants.	
Ditto	141,000 } Hydrants.	
Highgate Hill. .	267,000	
Chetwynd Road .	260,000	
Leighton Road .	379,000	
Fortess Road . .	260,000	
Torriano Avenue .	861,000	
Crescent, Camden Road . . .	147,000	
Rochester Square .	892,000	
Cantelowes Road .	375,000	
York Road . .	212,000	
	27,759,000	at 9*d*. = £1040 19*s*. 3*d*.
Rent of 51 water meters at 42*s*. each . .		107 2 0
		£1148 1 3

District Supplied by the West Middlesex Water Works Company.

For Water Supplied for Road Watering during the Season 1883.

Position of Meter and Standpost.	Gallons used.
Munster Square .	260,710
Fitzroy Street. .	1,062,460
Tottenham Court Road . . .	1,291,630
Robert Street . .	1,121,720
Mornington Crescent	704,330
Cumberland Street, West . . .	381,620
Carried forward .	4,822,470

Position of Meter and Standpost.	Gallons used.	Price per 1000 Gallons.		£	s.	d.
Brought forward .	4,822,470					
Albany Street .	776,460					
Gloucester Road .	898,050					
Berkeley Road .	809,390					
Total . . .	7,306,370	at 9*d.*	=	273	19	9
9 Meters at 42*s.* each				18	18	0
				£292	17	9

The total cost of water for the season was £1314 19*s.* The rent of meters was £126, or nearly 10 per cent. additional upon the cost of the water.

The three Hydrants on West Hill, Highgate, have been placed because the gradient of the hill is too steep for the use in safety of loaded water-vans or carts. To each a meter has to be fixed, the rent thereof bearing an excessive ratio to the cost of water—in the most extreme case two guineas being the rent of the meter, 27*s.* 9*d.* the cost of the water consumed.

Where water is used in other cases by the local authorities (not being for domestic purposes), the charge is also by meter.

For example, urinals erected for the public convenience have to be frequently washed out to ensure cleanliness, and a meter is supplied for each, the annual cost of meter being 10*s.* In many such cases the rent of the meter exceeds the cost of the water, as is shown in the table below; but where the supply of water is constant, as in urinals of more recent and improved construction, the proportionate cost of the meter is considerably reduced because of the increased quantity of water consumed.

RETURN AS TO CONSUMPTION AND COST OF WATER.

	Consumption of Water.				Cost of Water.											
	1880	1881	1882	1883	1880			1881			1882			1883		
	Thousands.				£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
Tottenham Court Road	98	108	223	668	2	9	0	2	14	0	5	11	9	16	14	0
..	..	..	..	..		..			..			..			..	
Ossulston Street . .	1	..	8	28			6		..			4	0		14	0
Gray's Inn Road . .	6	6	8	25		3	0		3	0		4	0		12	6
York Road	9	5	8	23		4	6		2	6		4	0		11	6
Goldington Crescent .	6	9	9	34		3	0		4	6		4	6		17	0
Pancras Road . . .	18	18	80	44		9	0		9	0	2	0	0	1	2	0
Mornington Crescent .	2	1	5	6		1	0			6		2	6		3	0
High Street	15	6	6	30		7	6		3	0		3	0		15	0
King's Road . . .	7	13	9	8		3	6		6	6		4	6		4	0
Camden Broadway . .	18	15	12	14		9	0		7	6		6	0		7	0
Kentish Town Road .	5	5	8	10		2	6		2	6		4	0		5	0
Chalk Farm Road . .	15	5	5	9		7	6		2	6		2	6		4	6
Seymour Row . . .	53	49	44	79	1	6	6	1	4	6	1	2	0	1	19	6
King's Cross Road . .	53	40	56	41	1	6	6	1	0	0	1	8	0	1	0	6
Oval Road	2	..	8	11		1	0		..			4	0		5	6
Brownlow Mews . .	..	6	11	19		..			3	0		5	6		9	6
Camden Gardens . .	..	..	..	316 18 mo		..			..			..		7	18 18 mo.	0
Angler's Lane . . .	..	..	..	373		..			..			..		9	6	6
Tottenham Court Road, by Chapel	55	68	58	39	1	7	8	1	13	11	1	9	0		19	6
Percy Mews . . .	37	35	33	10		18	3		17	3		16	6		5	0
Albert Road . . .	9	10	5	..		4	5		5	2		2	6		..	
Cumberland Market .	7	7	7	..		3	3		3	3		3	6		..	

The first 18 Urinals on this list are supplied by the New River Company, who charge
n the list are supplied by the West Middlesex Water Works Company—the meters are

RETURN AS TO CONSUMPTION AND COST OF WATER.

Average Consumption for past 4 years.	Average Cost for past 4 yrs.	Number of Stalls.	Average Consumption per Stall per Annum.	Average Cost per Stall.	Remarks.
	£. s. d.		Thousands.	£. s. d.	
106 (3 years average)	2 13 0	4	27	13 6	Macfarlane's Urinal
554 (2 years average)	13 17 0	12	46	1 3 0	Jennings' Urinal, rent of meter 10s.
12 (3 years average)	6 0	6	2	1 0	
11	5 6	4	3	1 6	
11	5 6	3	3	1 6	
14	7 0	5	3	1 6	
40	1 0 0	5	8	4 0	
3	1 6	4	3	1 6	Rent of meter 10s.
14	7 0	12	5	2 6	
12	6 0	4	3	1 6	
15	7 6	4	4	2 0	
7	3 6	6	1	6	Rent of meter 10s.
8	4 0	6	1	6	
56	1 8 0	4	14	7 0	
47	1 3 6	6	8	4 0	
7 (3 years average)	3 6	4	2	1 0	
12 (3 years average)	6 0	3	4	2 0	
	say 5 10 0	6	35	17 6	Jennings' Urinal, rent of meter 10s.
	..	6	62	1 11 0	ditto
67	1 13 6	4	14	7 0	
28	14 0	2	14	7 0	
8 (3 years average)	4 0	4	2	1 0	
5 (3 years average)	2 6	4	1	6	

10s. each per annum for the water meter fixed in each Urinal. The four Urinals last the Vestry's, and are kept in repair at the cost of the Vestry.

Distribution of Water.

The watering of public thoroughfares in large cities in the dry months of the year is a matter of detail requiring organization, but which usually fails to obtain general approval.

The practical difficulties are considerable, as the number of water-carts or vans required to meet the public requirements would have to be greatly increased if the wishes of the residents were always complied with. Each householder naturally wishes the carriageway in front of his own house watered at a time most convenient and agreeable to himself, and that in all probability would range from 9 o'clock in the morning till 7 o'clock in the evening.

But in thoroughfares of considerable traffic it is necessary to distribute water several times during the day. First it must be done early in the morning before the carriage-way is swept, and after the sweeping a second watering is necessary ; this would be about the time the traffic would commence, but shortly after all trace of watering would be effaced, unless the operation was again repeated.

In streets of lesser traffic the carts are sent round earlier in the day, in the middle of the day, and later in the evening, so as to work in with the exigencies of the heavier traffic.

But all these arrangements fail to command approval unless the residents themselves are practically familiar with, and give consideration to the difficulties of the operation moral as well as physical. Gentlemen engaged in trade appreciate the value of plenty of water, and in many instances, secure profuse watering by illicit means of beer or other enticement. In one case a licensed victualler himself complained that the macadamized carriage-ways of a square in his immediate neighbourhood suffered from too much water, at the very time that some of the inhabitants of the square were complaining of dust, several calling attention to the profuse watering of the paved carriage-way in front of the particular complainant's premises, with the generous

insinuation that a gratuitous supply of beer accounted for the extra supply of water.

Much of the efficiency of the water distribution depends on the regulations under which it is conducted. A little consideration will show the applicability of the principle that, in the morning the streets running north and south (except main thoroughfares) are to be watered before those running east and west, and the reverse of this in the afternoon. The sun being low in the morning, the streets running north and south would be wholly or partly in shadow for some hours, and would not dry up so rapidly as those streets running east and west, that are at the time exposed to the full force of the sun. The second watering must be arranged in the contrary way, as the full force of the sun at noon will be upon the roads north and south, while those east and west will be partly in shadow.

A full discharge of water should be cast upon the roads and over the entire surface each time of watering. Merely "laying the dust" is not sufficient, as in dry weather the effect is but very temporary. Experience proves that too much water is better than too little, although hasty and inconsiderate persons often complain of too much being used. It is easy for pedestrians to pick their way through mud, but they cannot escape from a cloud of dust. Besides the "clouds of dust" are seriously injurious to the goods in very many shops, and to the contents of private houses, but mud is not.

City of London.

The streets of the City of London are partly watered on the jet and hose system. In 1867 and 1872, experiments were made in washing the carriage-ways of Cheapside and the Poultry, when laid with granite pavement, and afterwards with asphalte pavement. The asphalte pavements of Old and New Broad Streets were likewise washed experimentally.

Hydrants were erected in Cheapside, at distances of 133 feet apart, and in Broad Street at 140 feet apart. Six men

were employed at each washing of Cheapside in the first trial, and ten men in the second trial; for which two jets of water were used during the time of the first trial. The work of the ten men in the second trial was thus distributed:—four in playing the jets, two in moving the hose from place to place, and four with brooms in sweeping the surface of the asphalte, and keeping the channels free from straw and larger refuse. These men also used "squeegees" (india-rubber sweeps) to dry the surface of the asphalte; of the six men employed on the granite pavement, four played the jets and two moved the hose and plied the brooms.

Washing Carriage Pavements with Jet and Hose.

Results and Experiments in the City of London.

Particulars.	1867. Granite Pavement, Cheapside, etc.	1872. Asphalte Pavement.	
		Cheapside, etc.	Broad Street.
Length . . . feet	2,000	2,000	1,436
Area of pavement washed sq. yards	9,792	10,353	3,671
Time washing . . .	2 h. 19 m.	2 h. 4 m.	1 h. 3 m.
Area washed per hour sq. yards	4,220	5,000	3,500
Water consumed . gallons	19,500	19,726	9,786
Ditto, per sq. yard gallons	1·99	1·90	2·66
Cost of labour . . .	9*s.* 10¾*d.*	9*s.* 0*d.*	4*s.* 10¾*d.*
Cost of water at 6*d.* per 1000 gallons	9*s.* 9*d.*	9*s.* 10¼*d.*	4*s.* 9*d.*
Cost for labour and water, one day's washing . .	19*s.* 7¾*d.*	18*s.* 10¼*d.*	9*s.* 7¾*d.*
Cost for labour and water per sq. yard . . pence	·0241	·0218	·0315
Cost for labour and water per sq. yard per year pence	7·510	6·823	9·859
Add for supervision, preparing apparatus, wear and tear, etc., 20 per cent .	1·500	1·377	1·972
Total cost . . .	9·010	8·200	11·831

The granite pavement was more thoroughly cleansed by

hose than in the ordinary way, by scavengers. The cost of washing asphalte was only 3 or 4 per cent. less than for granite.

Mr. Lovick in evidence before the General Board of Health, in 1850, stated that in surface cleansing by a jet and hose, the quantity of water consumed was at the rate of rather less than one gallon per square yard of surface of carriage-way working at "extremely low pressures." He mentions experiments made by Mr. Lee at Sheffield with "very high pressure," in which Mr. Lee effected the cleansing with a consumption of less than a third of a gallon per square yard. Mr. Lovick estimated that the footpaths could be cleansed with a consumpton of half a gallon of water per square yard. He adds that the daily cleansing could be effected at a cost of 3*d.* per house per week, exclusive of the cost for water; for which he allowed 28 square yards of carriage-way and 16 square yards of footway per house. At this rate, the first item of cost per square yard of surface would amount to $3\frac{1}{2}$*d.* per square yard per year. For water, the cost at 6*d.* per 1000 gallons, would be $1\frac{1}{2}$*d.* per square yard per year. The total cost would be 5*d.* per square yard per year.

Mr. Lovick at the same time estimated that the cost of cleansing by ordinary scavenging was nearly double the cost by jet and hose, whilst the jet had been shown to be much more efficacious in removing evaporating matter and filth.

It is found by experience in the City of London, that the most favourable period for using water is when the surfaces of wood pavements and asphalte pavements are in a moist and greasy condition. The mud can then be most readily removed from the surface by the water. In dry weather the system of jet and hose has also been employed, but when there has been a considerable fall of rain, it has not been found necessary. The washing is always done at the periods of the night when there is least traffic. The pavements of wood and of asphalte in the main thoroughfares, as well as those in the minor streets, are mainly those which

are washed. The washing is performed on occasions throughout the year, and it has no doubt resulted in the streets being kept in a cleaner condition than before. The courts and alleys inhabited by the poorer classes are washed with jet and hose twice a week between the months of June and November. The quantity of water used for the washings of streets and alleys was, in 1882, upwards of 10 million gallons; and in 1883 over 4½ millions.

Mr. Ellice Clark, a few years ago, recorded the results of observations in watering the streets and roads of Reading, where there were about 23 miles of macadam. Of these 17 miles were watered twice a day, for which purpose 11 watering carts and barrels and 4 hand-watering machines were employed. One cart waters a length of 5962 lineal yards, having an area of 23,849 square yards, twice a day, at a cost of 8*s.* for horse, cart, and man, and 1*s.* 5*d.* for maintenance of cart and harness, and shoeing; total 9*s.* 5*d.* per day. With one hand machine 23,740 square yards are watered twice daily, at a cost of 2*s.* 10*d.* each for two men, and 7*d.* for maintenance; making a total daily cost of 6*s.* 3*d.*

	Area watered twice daily.		Cost per day.	Water delivered per sq. yard.
One water cart	23,849	sq. yards	9*s.* 5*d.*	0·51 gallons.
One hand machine	23,740	"	6*s.* 3*d.*	1·30 "

Improved Distribution.

In 1872 a new water-van was introduced in the Metropolis by Messrs. E. H. Bayley and Company, of Newington Causeway, constructed by the firm on plans suggested by and arranged with the Authorities of St. Pancras. Several novelties were introduced, the principal improvements being increased capacity in the tank (450 gallons in place of the 220 gallons of the old water-cart), the mounting of the tank on four wheels instead of two, and the exact balancing of the tank, so that the draught of the van should be less trying to the horse, the animal being at the same time relieved from the heavy weight on the cart shafts and the straining action on the shoulder produced by the

swaying of the water in the two-wheeled cart. It was found, as calculated, that 48 vans, in less time, did work equal in area to that previously done by 72 carts, at a reduced outlay for horse hire of about £30 for each van per annum.

The success of "Bayley's Hydrostatic Van" was pronounced, and it was rapidly adopted in almost all the towns in the Kingdom, in Europe, South America, and many of the Colonies, as many as nearly 2000 being called for in the ten years.

Success begets imitation, and Bayley's van has of late years been widely imitated by many van builders, so that there is no difficulty in obtaining it or some of the imitations; but Bayley's van has not been materially improved upon. Variations of detail have been introduced by the imitators, but such of those as are really new are not good, and those that are good are not really new.

The following statement gives a comparison of the day's work (6 A.M. to 5.30 P.M.) of a Bayley's Hydrostatic van, and of an ordinary water-cart superseded by the van.

	Bayley's van.		Water cart.	
Capacity of tank in gallons . .	450		220	
	Hours.	Minutes.	Hours.	Minutes.
Average aggregate time of filling .	1	58	1	56
Travelling from standpost to work and back, aggregate . .	3	26	4	49
Aggregate time of spreading .	4	21	3	0
Day from 6.0 A.M. to 5.30 P.M.—Rest: breakfast, ½ hour; dinner, 1 hour.				

The aggregate time of filling depends upon the pressure in the main to which the standpost is attached. The time occupied in filling a van varies from two to seven minutes. A cart proportionately less, but the cart of course has to make a larger number of journeys to cover the equal area.

SNOW.

Removal of Snow.

No practical provision is made by systematically organized arrangements previously decided upon in the large cities of Great Britain for the removal of snow, although as concerns the Metropolis very elaborate and stringent provisions were enacted by Michael Angelo Taylor's Act, 57 Geo. 3, cap. 29 [1817], and repeated in other statutes, as may be judged by the following clause.

Footways to be swept daily during frost and snow.*

63. "And be it further enacted, that every occupier of any house, tenement, warehouse, shop, shed, coach-house, stable, chapel, meeting house, or other public or private building in any street or public place in any parochial or other district within the jurisdiction of this Act, during the continuance of frost, or after or during the fall of snow, from time to time, and at all times hereafter, shall once in every day before the hour of ten of the clock in the forenoon of each day, except Sunday, sweep and cleanse, or cause to be swept and cleansed, the footway all along the front side or back walls of their respective houses, tenements, warehouses, shops, sheds, coach-houses, stables, chapels, meeting houses, or other public or private building; and that every occupier who shall neglect so to do shall for every such offence forfeit and pay any sum not exceeding the sum of 10*s.*, to be levied and recovered and applied in such and the same manner in which other penalties are by this Act hereinafter directed to be recovered and applied; and also that the owner or owners of any house or other tenements within

* See also 2 & 3 Vict. c. 47, s. 60, for further improving the police in and near the Metropolis.

the jurisdiction of this Act, which may be let, furnished, or in divided apartments, shall be deemed and taken, for the purpose of this provision, to be the occupier or occupiers of every such house or other tenement respectively."

That reads very well, is stringent enough, and sounds as if it ought to be effectual, but in experience it is found to be absolutely inoperative for all practical purposes.

At times, for periods of several years, the Metropolis is not visited with a heavy fall of snow, and when such fall does occur, the constant variations of temperature are such that the visitation seldom leads to great inconvenience.

From Footways.

The sundry provisions made by Acts of Parliament require every householder to remove snow from the front of his residence before a fixed hour in the morning, but in very few instances do the householders trouble themselves to comply with these requirements.

The inhabitant of one house may very conscientiously send out a man to cleanse the footway, whilst his next door neighbour religiously refrains from doing anything of the sort. A large percentage of householders do not think it worth while to give any attention at all to the matter, until incidentally a labourer with broom and shovel comes along and offers to "clean your door-step."

By such time the snow has become trodden down and hardened, and consequently more dangerous to pedestrians and more difficult of removal.

In this, as in many other matters, there are duties imposed alike upon the police and also upon the Local Authorities. Notices to remove snow are in no instance served upon the householders before the fall, and such a service after the snowfall is necessarily too late to ensure attention to the desired purpose.

In the event of householders being careless or obstinate and neglecting to clean the footway in front of their houses,

the police may take out summonses against a few or against a large number. If only a few are summoned, they complain when before the magistrate of being selected, and urge that all should be served alike. If a large number be summoned, the magistrate takes objection to the time of the court being wasted, remarking perhaps that one summons would have established a case and a precedent. Again, some ten days elapse between the issue of the summons and the hearing before the magistrate, during which time a thaw has set in and the snow has disappeared. Probably the first question asked by the magistrate is, "Is the snow there now?" and the answer being in the negative, the magistrate curtly says, "summons dismissed," the householder is pleased to escape, on the next snowfall neglects his duty again, and the police authorities are disheartened at their failure and are not zealous in future.*

Now if the Legislature be in earnest in requiring every householder to cleanse the footway in front of his house when there is a fall of snow, or if the community itself be in earnest in the matter, the procedure is clearly defective, to say the least of it.

A much more satisfactory system would be somewhat as follows.

At eight o'clock in the morning—if that be the hour fixed—police constables or other duly appointed authorities should pass along the streets and record the number of every house where the footway is not cleansed from snow. A report of the facts, with a list of these houses, should be laid before a magistrate on that day, and a fine absolutely and necessarily imposed upon every person included in that list. This would have the effect in a very short time of inducing the residents to make it expedient to arrange with labourers (who might easily be dealt with at such seasons, when employment is scarce,) to do the necessary work before the specified time at a very trifling cost.

Even this would require a certain amount of organization. The arrangement would have to be made in anticipation

* This is narrative of fact.

of a fall of snow, and the necessary number of men would have to be provisionally engaged by a foreman or ganger, who would make himself responsible to the residents of the particular street.

In the absence of such an arrangement as this, and if considered desirable, as in many instances it would be, that the Local Authority should undertake the duty at present cast upon the householder, prevenient organization would meet the difficulty. Gangs would be—provisionally—formed for certain streets, and unemployed labour would be in anticipation drafted into such gangs for employment in event of snowy weather.

FROM CARRIAGE-WAYS.

In great cities the absolute removal of snow from the whole area of the public ways is extremely difficult.

In the immediate vicinity of rivers a certain quantity of snow can generally be discharged and carried away by the running stream at once from the town; but where town extends miles from the banks of the river the stream ceases to be an available medium of removal.

Should the residents clear their footways, the accumulation of snow becomes great, and from time to time greater, in the roadway, because the local authority alone is required to keep the carriage-way free.

Even in thoroughfares where the traffic is great and snow ploughs are used, the snow is not always removed effectively, the plough simply clearing the middle.

The centre of the carriage way alone is available for traffic, which is rendered possible and facilitated only by the Local Authority maintaining the same by the free use of gravel or salt.

Salt dissolves the snow, but by many medical men it is considered an extremely injurious operation.

The use of gravel is a partial remedy. It enables the traffic to be conducted along the carriage-ways by the

constant and repeated application, and this may be facilitated by the use of numerous sanding machines.

A succession of snowfalls of course increases the difficulty of applying palliative remedies, and at times it is found that the traffic must be stopped unless the snow is actually removed and as quickly as possible.

The great difficulty in large towns is to find spaces to which to cart the snow, and the larger the town the greater the difficulty, generally because of the scarcity at such times of vacant space.

The snow could be deposited in the parks, but the verdure would suffer, and in paved open spaces an accumulation is objectionable, for the reason that it would remain there for weeks after the thaw had set in.

In such a great city as the Metropolis, if prevenient arrangements had been organized, it would be feasible to remove the snow in its earliest stages into the deeper sewers, where it would be rapidly dissolved by reason of the higher temperature; but the authorities having jurisdiction over these sewers might object to the intrusion of an authority having jurisdiction only over the surface. In fact, cases have occurred where the sewer authority has objected to the sweeping of melted snow down the gullies having connection with the sewers below, although the snow must necessarily have become dissolved long before it could have reached the deeper sewers. The mud from the surface of the roads which might have been swept into the gullies with the snow would simply represent the detritus, that would have been immediately and necessarily swept into the sewers if the snow had descended in the form of rain.

Snow Storms.

There have been of late years—notably, 1867, 1871, 1875, 1876 and 1881—a few heavy snowstorms in the Metropolis, when special means were necessarily adopted for dealing with and removing the snow.

Carting Snow.

One of these occurred early in the morning of Wednesday, the 2nd of January, 1867. In the parish of St. Pancras (mileage of carriage-ways about 80 miles), the first step taken for dealing with the snow, was to clear the gullies and channels of the main thoroughfares. Then the snow was cleared away for a width of about ten feet from the kerbs, where it was loose and easy of removal. The work was continuously carried on from Wednesday morning until Saturday night; 300 men with 120 carts were employed in the operations, and over 7000 loads of snow were removed. A thaw set in on Sunday morning. Nearly 300 men were employed during that day in keeping the gullies and channels clear, not only in the main thoroughfares, but also in the side streets. The efficacy of the operations that were undertaken was demonstrated by the fact that, rapid and sudden as the thaw had been, there was no case of flooding in any road in the parish. Shoots were improvised in the open squares and on the open space now marked by the Cobden statue, where a huge mountain of snow was accumulated. Nevertheless, whilst there are 80 miles of road in the parish, the work of clearing away 7000 loads of snow, extended over only 10 miles of carriage-ways. These figures give 700 loads of snow removed in partially clearing one mile of way; and they demonstrate the difficulty and arduous nature of the work to be done in any endeavour to remove a "snowfall." As to the supply of labour, all who applied were engaged, though there was no great readiness to fall to work. A party of eight "got-no-work-to-do" able-bodied men were singing in the carriage-way past the offices. They were hailed, and shovels offered to them. Wages, 3*s.* a day, to lift light snow into carts. They declined the offer of work, and went on their way singing—it should have been, "we-want-no-work-to-do."

Gravelling the Carriage-way.

On the occasion of the snowstorm of 1871, a different course was adopted in St. Pancras for dealing with the carriage-ways during and after the storm. The gullies and channels were first cleared as before, but the snow was spread over the crown of the roadway. The number of hands employed amounted to 390.

Little more snow fell; but for 12 days, during the continuance of the frost, the main thoroughfares were continuously dressed with gravel, burnt ballast, granite sand, and screened Thames ballast, and the traffic was maintained with comparative ease. About 1500 cubic yards of material were distributed during the twelve days, at an outlay of £375. When the thaw set in, the "sweeping gangs" were further employed in clearing the roadway and facilitating the escape of the water to the channels, and in sweeping the main thoroughfares. The extra labour cost £250.

Salting the Carriage-way.

After the snowstorm of the 2nd December, 1875, followed by frost, terminated by a thaw on the 10th, the system of melting by the use of salt was adopted in St. Pancras. Coarse agricultural salt was freely applied in the middle portions of the carriage-ways; and the liquid slush was assisted by brooms and scrapers through grips cut in the accumulated snow at the sides into the channels and thence to the gullies.

Another fall of snow took place on the 12th of January, 1876, succeeded by a thaw which set in on the 17th of the same month. The efficacy of the salting process was again tested; and it is convenient to form some comparison between the results of the salting treatment on the two occasions of snowfall in December, 1875, and January, 1876. On the first occasion eight roads were partly salted by the Tramway Company, fourteen roads partly by the Omnibus

Company; and 106 roads and streets for the whole width by the Vestry. Of the 22 streets partly salted by the tramway and omnibus companies only the middle of the carriage-ways were treated by the companies, the sides being salted by the Vestry. On the occasion of the fall in January 1876 the carriage-ways which were salted were somewhat more numerous. The quantities and costs were as follows:—

	Dec. 1875.	Jan. 1876.
Salt, chiefly coarse salt, consumed .	42 tons.	36 tons.
Cost of salt used	£82	£75
Snow carted away	1769 loads.	465 loads.
Cost of carting away snow . .	£331	£87
Cost of extra hands employed . .	£195	£45

Effect of Salt.

The experience gained showed that the use of salt is an efficient mode of dealing with the snow; that, used in liberal quantities, it rapidly melts the snow, and that the greater the traffic the more speedily the snow is melted; but that it is absolutely necessary that the mixture of salt and snow should be swept away as rapidly as possible after it assumes a liquescent condition. Weak macadam roads are seriously affected by the mixture, for the salt appears to penetrate and disintegrate the softer material under the shallow coating of granite or hard surface material. The grouting of paved roadways would seem also to be injuriously affected by it.

The report of the Medical Officer of Health to the Vestry of St. Pancras, made in January 1876, throws much light on the risks incurred to health by the use of salt, the absorption of brine into boots and shoes, and the permanent state of cold dampness which ensues. The following is the text of the report:—

"I am of opinion that the salting of frozen roads, for the purpose of thawing them, may be attended with consequences injurious to the health of the public.

"When ice or snow is melted by mixing it with salt,

the temperature of both substances is greatly lowered, and the resulting liquid brine has a temperature about 30 degrees below the temperature of the substances before admixture. Any one stepping into such cold brine might receive a very severe chill in the feet, and serious consequences might ensue.

"After the lapse of some time the brine attains the temperature of the ground upon which it rests, but although the brine remains liquid it is not warmer than the neighbouring ice and snow, and, until a general thaw sets in, the brine remains icy cold. To step into such brine might cause a dangerous chill of the feet.

"There is a further and perhaps more serious danger from the following causes: boots saturated with brine are dried with the greatest difficulty, and only by the aid of a moderately warm atmosphere and a free current of air. When dried they again readily absorb moisture from the atmosphere, and become again moist. In fact, boots soaked in brine will not dry upon the feet in very cold weather. If the public, during a frost, are compelled to step upon briny, slushy roads, they will have to go about in damp boots, and this could not fail to be prejudicial to health.

"I believe that in one way only could salt be used with safety for thawing ice-bound roads in large towns. This would be to thaw the roads by means of salt, and immediately afterwards to remove the liquid slush, and coat the roads with sufficient sand to render them dry again."

Salt and Sewers.

In dealing with the snowstorm of the 18th of January, 1881, which lasted eighteen hours consecutively, in St. Pancras salt was at once freely applied along all the main thoroughfares by the tramway and omnibus companies, and by the Vestry in the manner described in dealing with the storm of December, 1875. Sixty-five tons of salt were disposed of. The central portions of the main thoroughfares

were, before the lapse of many hours, made passable, and extra hands were engaged to clear channels, and remove the snow from intersections of important thoroughfares. No attempt was made to remove the *bulk* of the snow by cartage, although 2000 loads were actually removed. Nearly 650 men were employed on the same work. Nearly 500 loads of snow were discharged into the district sewers. The warm temperature below quickly disposed of the snow; but there was no chance of flooding the sewers, as the delivery of the snow into the sewers was but comparatively gradual. The steps taken to clear the fall of snow may be summarised as follows:—

1st. The employment of an unlimited number of labourers to drag the snow from the middle of the roads to the breasts. About 500 volunteered, and were taken on at 3*s.* 6*d.* per day, with a proportionate increase in the number of supervisors.

2nd. Reduction of the snow by salting profusely those streets as the clearance took place.

3rd. Clearance of channels with gaps cut in the snow accumulations, and profuse salting so as to facilitate drainage and the rapid sweeping of slush to gullies.

4th. Cartage of snow, firstly, from all important intersections, subsequently from the main roads.

5th. Deposit of white snow in the district sewers by means of the side-entrance galleries, with a sufficient number of men underneath to keep it below the level of the drain-mouths, and the use of pure carbolic acid to ensure more rapid melting.

In the City of London, visited by the same snowstorm of January 18, 1881, it was estimated by Colonel Haywood that the fall of snow averaged 6 inches in depth, making about 500,000 cubic yards on the entire area of the city. It was estimated that 133,000 yards were on the public ways, of which 70,000 were on the main lines of thoroughfare. Attempts were made to melt the snow, before the fall had ceased, by sprinkling it with rock-salt, but they

were not successful. The quantity of snow actually carted away was approximately as follows :—

	Cubic yards.
3,615 days of extra single-horse cartage . .	54,225
111 days of two-horse carts	2,220
7,000 loads removed by Commissioners' carts .	14,000
Total removed	70,445

The greater portion of the snow was carted to London Bridge and Blackfriars Bridge, and there shot on to the footpaths, whence it was shovelled over the parapets. Large quantities were deposited upon land at Golden Lane, 2 acres in extent, that happened to be available, and on open spaces elsewhere. The work of removing the snow lasted twelve days, till the 29th January. The number of extra men employed in the work was increased from 233 on the 18th to 1368 on the 24th, and reduced to 137 on the 29th, the last day of clearing. These were in addition to 350 men and boys in the regular service of the Commission. The total cost of the work, exclusive of ordinary daily expenditure for the cleansing of the public ways, amounted to £4254. During the same period, 1,812 loads of ordinary dust and refuse were removed from the streets.

Snow-clearing in Milan.

In Milan, the snow-carts are emptied into the navigable canals and numerous watercourses by which the city is intersected; and latterly also into the new sewers in the central portion of the city, which are promptly flushed whenever it snows. During the winter of 1879–80 the cost of clearing the 1,656,200 square yards, total area of squares, streets, and lanes within the city walls, averaged £200 per inch depth of snow fallen, and for the 502,800 square yards outside the walls the average cost was £62 per inch depth, equivalent in each case to about 1·05*d.* per cubic yard. Ordinarily the clearing of the more frequented streets is completed within eight or ten hours after it has stopped

snowing; and of the rest within twenty-four hours, not reckoning night.

The organization of the arrangements by which this work is accomplished with such remarkable despatch and efficiency, is the work of Signor Annibale Gafforini. The city is parcelled out into small districts, numbering 112 for last winter, of varying extent, according to the importance of the work in each. An average rate of pay per inch depth of snow fallen is settled for the whole area of each separate district, according to its extent and the particular conditions affecting the several districts and squares comprised within it. Each district is allotted to a contractor, who usually associates with himself six to ten partners, besides the labourers whom he employs. He has to find carts, horses, and carters; the necessary implements—spades, shovels, brooms, scrapers, mattocks, barrows, &c.—are furnished by the city, under suitable stipulations for ensuring proper care in their use. A copy is given of the complete form of contract now employed, comprising upwards of thirty clauses. The contracts are made annually, and the same persons almost always apply for them again year after year. The contractors come principally from the trades that are interrupted by winter—paviours, bricklayers, and masons, and gravel quarrymen. For the direction and supervision of the work the whole city is divided into four sections, over each of which is appointed an engineer with an assistant, who are aided in the general arrangements by police surveillance.

Payment is made only for work effectually done. In each snowstorm the depth of snow falling, which is the basis of pay, is ascertained by means of a number of stone posts, fixed in suitable open spaces, clear of shelter from buildings, and each capped with a flat horizontal slab of stone. As soon as it stops snowing, or two or three times during a storm of several hours, the depth of snow, caught on the slabs, is measured by the engineer in the presence of two of the contractors in his section.

The number of men ordinarily engaged in snow clearing

on a winter's day is not less than 2000 and has sometimes risen to 3000. The stock of implements found by the city, representing a capital of about £1600, is housed in two stores in opposite quarters of the city. In the winter of 1874–75 the total fall of snow amounted to 40¾ inches, and the whole expenditure for clearing it within the city walls exceeded £8400; while in 1877–78 the fall was only 5¼ inches, involving an expenditure of less than £1040 for a slightly larger area.

Snow-clearing in Turin.

Turin and its suburbs are divided into three districts, of which two are urban, comprising all the paved roads, and one district is surburban, comprising all communal roads. Each district is subdivided into sections varying in number from five to eight. The work is done by petty contractors, who find labour, horses and carts, and is paid for at a price per centimetre of snow fallen. The city provides tools. The street-sweepers are also employed at the intersections of main streets and other important points, and to sprinkle sawdust, &c. on the roads.

The snow is first thrown up into heaps and then thrown into the sewers, rivers and canals, or stacked in special places. The sewers are flushed from a canal in the upper part of the city.

Several mechanical methods of melting the snow have been investigated with the following results. Garneri's tube calorifer consists of a galvanized iron pipe with a fire at one end, and a fan for drawing hot air through it at the other. The snow is heaped round the tube. The cost amounted to 2⅓*d.* per cubic yard (without reckoning the cost of the apparatus) as against 1*d.* per cubic yard for clearing away in the usual manner. The pyrohydro melting plough was a machine proposed by Garneri for melting the snow *in sitû*, but did not seem worth trying. Nawckins and Mullaly's (New York) snow melter consists of a boiler from which a mixture of steam with the gaseous

products of combustion issues in one or more jets upon the snow. The cost for fuel alone would be ¾*d.* per cubic yard of snow melted, to which must be added interest and sinking fund for machine, costing £1280. Bouvet's system resembles the tube calorifer, but the tube is pierced with small holes from which steam issues. Melting by salt.—It has been found in Paris that 0·36lb. of salt is required to melt a frozen stratum 1 yard square and 1½ to 2 inches thick. The price of salt in Turin being 2*s.* 4*d.* per lb., the cost would amount to 16*d.* per cubic yard. Wells as receptacles for snow.—It not being thought advisable to try any of the above systems, it was proposed that a well should be dug to receive the snow from one contract. The subsoil of the city is gravel, through which a large body of water passes. A well 16 feet 6 inches in diameter, 42 feet 6 inches deep, amply sufficed in 1880-81 to receive the snow from an area of 13,150 square yards. This system is rapid and economical where the cost of cartage exceeds ¾*d.* per cubic yard.

The area from which the snow was removed in 1880–81 was 2,800,000 square yards; the total depth of snow was 1·41 foot. There were 121 contractors. The number of men sometimes amounts to 4000 (besides the regular sweepers), and 500 carts. On January 19, 1881, 3684 men, and 475 one-horse carts were employed to clear away a depth of 0·46 foot of snow. The average cost for clearing and carting a cubic yard is 0·93*d.* in districts 1 and 2. In district 3, where it is only heaped up, it is 0·4*d.* In addition to these amounts paid to the contractors there is the cost of providing and maintaining tools, and the charge for canals, &c.; these items, with superintendence, add from 20 to 25 per cent. to the cost. The total cost per inch depth of snow is £274.

The tramway companies have to bear their share of the cost, and pay for clearing a width of 9 feet 10 inches for single, and 19 feet 8 inches for double lines. For a length of 17½ miles of tramway, the cost is £12 11*s.* per inch depth of snow.

The question of letting the work to one or two large contractors has been considered by the authorities, but the present arrangement is thought to be the best. In the event of dispute with a large contractor, the snow would be left lying in the street, while the men now employed can be dismissed at a moment's notice and readily replaced, and they are satisfied with a lower rate of pay than a contractor would demand, who provided his own tools, and was required to have large gangs of men always available, with the possibility of having no work for them throughout the winter. The superintending staff consists of twenty engineers and assistants, who take great interest in the work, which involves much responsibility in cases of emergency. In the busiest parts of the city, the snow is heaped up by 9 A.M. when the depth does not exceed 6 inches, and is cleared away within twenty-four hours. In all the inhabited parts, the heaping up is done in one day, and the removal in two days more.

SCAVENGERING OF PARIS.

THE cleansing of the public thoroughfares in Paris, formerly undertaken by the Prefect of Police, is now a function of the Prefect of the Seine. The staff consists of two engineers, one for each group of arrondissements, one group being subdivided into three sections, each under the charge of an executive engineer, and the other into five sections, similarly supervised. These sectional engineers have under them fifty-one superintendents, and sixty-one overseers, whose employment imposes upon the municipal budget an annual cost of 260,000 francs. The scavenging plant is kept in a central depôt, where materials of every description are stored and classified for ordinary and extraordinary service when snow and ice render additional assistants necessary.

The roads of Paris extended in 1877 over a length of 558 miles, and they covered an area equal to 3,523 acres, more than 18 per cent. of the total area of Paris within the fortifications.

	Square yards.	Square yards.
Paved roads	6,349,527	
Macadamized roads. . .	1,972,582	
Asphalte roads . . .	296,127	
		8,618,236
Unmetalled roads (natural surface) . .		242,782
(53 per cent.) Total area of the roads . .		8,861,018
(47 „) Footpaths and blind alleys .		6,691,636
Total of all classes.		15,552,654

The depôts contain supplies of chloride of lime, sulphate of zinc, sulphate of iron, and carbolic acid, as disinfectants ; and hydrochloric acid, nitro-benzide (*acide de mirbane*) as

cleansing agents. The chloride of lime, of a strength of 100° to 105°, is successfully employed for the disinfecting of places tainted with urine or fæcal matter, also for the cleansing of gutters carrying sewage matters. Sulphate of iron and sulphate of zinc are both used under the same conditions. Sulphate of iron possesses the disadvantage of rusting objects to which it is applied. Sulphate of zinc is stronger in its action, but costs a little more. It produces no smell, nor does it leave any trace. It is much employed in summer in washing and watering the basements of the *halles centrales*, used for fish, poultry, and offal. At a strength of $\frac{1}{8}$th, and mixed with 3 per cent. of sulphate of copper, sulphate of zinc makes a good disinfecting liquor, which preserves its qualities a long time, and is of great use in private houses. Carbolic acid is not, strictly speaking, a disinfectant; it does not act like chloride on putrid matter, but arrests and prevents fermentation, doubtless by destroying the spores. It is, therefore, always employed when it is desired to destroy the germs of putrid fermentation. It is used at a strength of about $\frac{1}{40}$th, say a gallon of the acid to 40 gallons of water. At a strength of $\frac{1}{100}$th and $\frac{1}{200}$th it gives good results for watering once or twice a week in summer those parts of the *halles centrales* liable to infection. It is even used as low as $\frac{1}{1000}$ th for watering streets and gutters. Hydrochloric acid is applied to urinals and slaughter-houses. In places much incrusted with tartar, it is used at a strength of $\frac{1}{6}$th. Lowered to $\frac{1}{10}$th, it cleans smooth walls and flags efficiently. In ordinary rinsings a strength of $\frac{1}{15}$th suffices. It leaves a disagreeable odour behind, which however is quickly dissipated. Mirbanic acid (nitro-benzide) is more energetic than the foregoing, but it produces a disagreeable smell of bitter almonds, and leaves a white film which has to be washed off. It is used at the same strengths as hydrochloric acid. The annual cost for plant and disinfecting materials of all descriptions is £8800.

The engineers of the city of Paris are also charged with the sweeping of the roads, which is performed daily,

between 3 and 6 A.M. in the summer, and between 4 and 7 in the winter. The carts for removing the public and private refuse work from 6 to 8 A.M. in the summer, and from 7 to 9 in the winter. The filling of each cart is attended to by the driver, aided by two shovellers, the latter having to provide during the rest of the day supplemental sweepings wherever required, to rinse the gutters twice a day, and to clean and disinfect urinals, &c. These matters are ordinarily finished by 4 o'clock in the afternoon, except in unfavourable weather. The engineers have at their disposal a staff of—

	Fr.	C.		Fr.	C.	
2200 men, at from .	2	50	to	4	0	per day.
950 women, at from .	0	20	to	0	25	per hour.
30 children (boys), at.	.	.	.	0	20	"

In addition there are 190 mechanical sweepers, and as each machine represents the effective work of 10 men, the total scavenging staff may be considered as composed of nearly 5000 labourers.

The mechanical sweepers, which after numerous trials and much hesitation, have been introduced into Paris, are the English machine, improved by M. Sohy, and the machine of M. Blot, the former being preferred. The mechanism of both is simple, works with regularity and occupies little space; it consists of a framework upon two wheels, with a seat for the driver. At the back is placed the sweeping apparatus, composed of an inclined circular bass broom, actuated by gearing driven from one of the wheels of the carriage. By means of a clutch the driver can from his seat easily put the broom in or out of gear. The machine is employed in all weathers, and works as well on paved roads as upon macadam or asphalt. Each machine weighs rather over 14 cwt. and can be drawn by one horse. It sweeps about 6578 square yards per hour. The cost of a machine is £40, and its annual maintenance, exclusive of renewals of the brush, £8. The cost of a new brush is about £2 16*s.* 0*d.*, which will work for from one hundred and sixty to two hundred and eighty hours.

The Paris mud no longer possesses the manurial strength of former times, and in consequence the receipts derived by the municipality from this source have greatly diminished. It is at present disposed of by public tender to responsible contractors for terms of about four years. For its removal there are daily employed 520 carts and 980 horses. The average bulk removed per day is about 2223 cubic yards.

Snow.

When a fall of snow occurs, attention is first directed to clearing the footpaths and crossings, so as to insure uninterrupted circulation of foot passengers. The town scavengers sand the roads wherever it is necessary for the carriage traffic. At the same time numerous auxiliaries are organized to remove the snow from the principal thoroughfares, in the order of their relative importance. For removing the snow the General Omnibus Company are bound by their concession to furnish fifty waggons; and carts are specially arranged for with the providers of sand and gravel at the beginning of winter, the contractors for maintaining the public roads being also bound to hold their carts at the disposition of the sectional engineers. In certain cases the half-melted snow is swept into the sewers, especially those carrying warm water. Melting by steam has been tried, when a continuous jet was introduced into a mass of banked snow; but it melted very slowly at first, and the melting ceased after the cavity had increased to a certain size. Two descriptions of snow-plough are kept in store, one for manual the other for horse-power; but they have never been used, as the coating of snow seldom attains sufficient thickness, and as it is too quickly compressed and hardened by the traffic. As a rule the sum allowed in the budget, about £7000, suffices for the extra labour incurred; but occasionally severe winters cause this to be greatly exceeded, as in 1875-76, when the increase amounted to £8000.

WATERING.

Both hose and carts are used for watering the thoroughfares, the former for the boulevards, the avenues, and a certain number of first-class streets. The watering plant belongs to the municipality. Three descriptions of cart are in use ; two heavy wooden ones are now being superseded by the third, Sohy's cart, made of sheet iron. The carts contain 220, 242, and 286 gallons respectively, and will water from 2400 to 3350 square yards. The watering by hose is attended to by the ordinary street cleaners, who can easily water 24,000 square yards in thirty-five minutes, deducting the time necessary to connect the apparatus with the mains. There are three hundred and twenty-two water carts, which on the average disperse 1,311,200 gallons of water over a surface of 7,139,163 square yards. A surface of 2,783,092 square yards is watered by hose, and this system is being greatly developed on account of its convenience and cheapness. The annual cost of watering is £18,000.

The cost per year for maintenance and scavenging, exclusive of general charges, was for the first, second and third roads already noted, as follows :—

	Maintenance per Square Yard.	Cleansing per Square Yard.	Total per Square Yard.
Stone pavement . .	4·50*d.*	3·37*d.*	7·87*d.*
Macadam . . .	9·25	7·31	17·26
Asphalte . . .	10·20	4·17	14·37

Here is shown that asphalte costs nearly as much as macadam for maintainance and cleansing ; and if the interest on the excess of original cost for asphalte above that for macadam be added, the annual charge for asphalte will be greater than that for macadam.

The amount of special charges for urinals, watering, removal of snow and ice, &c., is at the rate of ¾*d.* per square yard.

Scavengering of Lille.

The town of Lille is one in which the scavenging is most thoroughly done. The road scrapings are greatly prized as fertilizers by agriculturists in the neighbourhood. It costs the local authority 1*s.* 6*d.* per cubic yard to collect the refuse and to carry it to the depôt; and it is sold to the farmers for 1*s.* 2½*d.* per cubic yard, securing a ready sale. The cost of carriage by rail is 1*s.* 5*d.* per cubic yard, for a distance of six miles, and 2*s.* 3*d* for thirty-six miles. According to the results of analyses of old and recent samples of road scrapings, it is found that the theoretical values are, in the former case, 3*s.* 9½*d.* per cubic yard, and in the latter, 3*s.* 8½*d.* The mud deposit in sewers and drains contain from eighty to ninety per cent. of water, and is most foul and fœtid. After partially drying it till the water is reduced to 50 per cent., the residue contains nitrogen, 0·675; phosphoric acid, 0·81; potash, 0·18 per cent.; and the amounts are not greatly decreased when the deposit has been taken to a depôt, and stored for a time until it becomes partially air-dried.

Scavengering of Boston, U.S.

The scavenging of Boston devolves upon a committee of five members of the City Council, chosen annually. This committee, in January, makes an estimate of the appropriation required for scavenging during the year, and controls its expenditure; all work and the employment of all labour being in its hands. It is provided, however, by City Ordinance that scavenging shall be done to the satisfaction of the City Board of Health, and that the superintendent in actual charge of the work shall be appointed annually by the said Board, and approved by the Mayor. The Board of Health referred to consists of three members, appointed by the Mayor for three years, and approved by the City Council, one member going out of office each year. This Board takes cognizance of all

matters affecting public health, regulates noxious trades, abates nuisances, appoints the city physician, quarantine officers, and superintendent of health, and requires that the scavenging shall be done to its satisfaction.

The system has worked well. The committee, unable to become familiar with the work during their brief term of office, of necessity content themselves with auditing accounts, and with such investigations and suggestions as they are qualified to make, and leave its management entirely to the superintendent; the Board of Health, for somewhat similiar reasons, appoint each year the same person to that office, and the superintendent, being supported by both bodies, is relieved from many petty attacks and annoyances incidental to a more autocratic position. Practically, therefore, the charge of city scavenging is in the hands of one man, the Superintendent of Health.

It is obvious that no operation of magnitude, and scavengering less than many others, can be efficiently carried on except by those accustomed to it; and that it is well done at Boston, is due almost entirely to the fact that it is in charge of men fitted by long training for its performance. The superintendent has filled his place for twenty years, and graduated from an inferior position in the work; all of the foremen, twelve in number, have been promoted from subordinate positions; few of the labourers have been less than five years connected with the department, many have served for twenty, a few for thirty or even forty years. Although the rate of wages is not especially high, ranging from forty-five to fifty dollars a month, the permanency of the employment causes places upon the force to be eagerly sought for, and when a vacancy occurs, there are many applicants to choose from. A young able-bodied married man is usually selected. His first instructions are, "Mind your own business; do your work to the best of your ability; don't talk politics; don't talk religion." The men know that a faithful discharge of their duties will ensure continued employment, and may lead to promotion. Rarely is one found to neglect his duties.

Scavenging in Boston comprehensively includes the following items:—

Removal of house offal.

Removal of ashes and dry house dirt.

Cleaning of streets and street catch-basins.

Cleaning of privy-vaults and cesspools.

Offal, which includes refuse food and other fragments of moist organic matter, known otherwise as swill, is taken every day from hotels, restaurants, boarding-houses, markets and other places furnishing large quantities of it, and three times a week in summer, and twice a week in winter, from dwelling-houses. At about 4 o'clock A.M., men leave the department yards, of which there are four in different sections of the city. Each gang consists of a horse, waggon, driver and helper. The horses are handsome, well-grown beasts, weighing about 1,400 lbs., and come generally from Pennsylvania. The waggons, built by the city, which also employs 11 mechanics to do its own repairing, blacksmithing, painting, &c., are perfectly water-tight, hold from 3 to 4 cord-feet, and have a wooden cover or lid, which is kept closed, except when raised to receive the offal. They cost to build £52 each. Hanging below them are two large wooden buckets to be used by the men. Hotels and markets are first visited, so that the offal may be removed before early travellers and customers begin to arrive. Shortly after 7 o'clock, dwelling-houses are visited. Midway between the streets, in most parts of the city, there are narrow alleys upon which the rear of house lots abut, and through these the waggons drive, the driver or the helper rings the bell at the yard gate, or at the basement door, if there be no yard, and, on being admitted, quietly goes to the swill-tub, empties its contents into the bucket, replaces the tub, and leaving the house passes to the next one, and so on until his bucket is filled, when it is emptied into the cart. Should no offal be found at any house, it is assumed that it has been improperly disposed of, and the case is reported to the Board of Health for investigation. These operations proceed till 11 A.M., and from 1 to 5 P.M.

When the waggon is filled, it is driven to one of three department depôts in the city, and its contents dumped upon a raised platform. The waggon is then thoroughly washed with water and scrubbed clean before going upon another trip. It is required that all the offal collected in a day shall be disposed of before night. There is no lack of regular customers for it, who drive in from the suburbs and neighbouring towns. These men back their waggons under a shoot in the platform, and a full load is shovelled into them. The cubic contents of each waggon is known, so that proper charges can be made. These range from 4*s.* 2*d.* to 5*s.* 10*d.* per cubic yard, varying according to the accessibility of the depôts to the neighbouring farms. The waggons are required to be water-tight, and each has a number in plain figures, two inches long, so that it can be reported by the police in case of leakage or any other offence while passing through the streets. From the sale of offal in 1878 was realised the sum of £5564. During the same time 26,000 loads were collected at a cost for labour of £11,270, to which must be added £4000 for the total cost of removal. Ninety-six men and forty-five waggons are employed upon this branch of the work.

While the city claims the right to remove all offal, or, what amounts to the same thing, refuses to license any private individuals to carry it through the streets, a wise discretion is used in exercising the right. Farmers and others living in sparsely settled districts on the outskirts of the city limits, occasionally wish to use their own swill for feeding swine, and when this can be done without creating any nuisance it is considered proper and economical to permit it. This discretion is left with the superintendent.

For the removal of ashes and house-dirt 117 men and 58 single-horse carts are employed. The carts are built at a cost of about £26 each. Hotels, stores, and tenement houses are visited twice a week, and dwelling-houses once. The driver and his helper enter the house, yard or shed, carry out the ash-receiver, and, after emptying the ashes

into the cart, which has a canvas cover, return the receiver to its proper place. The men are not required to go up-stairs; and the ashes from tenements, and up-stairs offices and ware-rooms must be brought to the ground floor by the tenants. In dwelling-houses, the inmates have no trouble whatever. In most, if not all other cities, ashes, and often offal as well, have to be placed on the sidewalk to await the arrival of the scavengers, and, after being emptied, the receptacles are left where found. The Boston method is evidently a great convenience to householders. By it also is avoided the nuisance to foot-passengers of having to pass upon the sidewalk unsightly and offensive vessels or heaps of refuse awaiting removal.

When the cart is filled, the canvas is fastened securely over its contents, and the driver takes it to the nearest dumping-ground. In the mean time the helper, in order to expedite the work, continues to bring out ash-barrels so that they may be in readiness when the cart returns.

It is somewhat difficult to find accessible places for dumping the ashes; it may be doubted if it is possible to find unobjectionable places. A large part of Boston being very low land, there is great temptation to use this refuse in the place of earth filling; and such is its usual disposition. If the ashes were perfectly free from admixture with other substances, it would form suitable filling for most purposes, but it is not so. Although it is intended by the Health Department that only ashes shall be put in the ash-barrels, no rule to that effect can be enforced. By requiring that there shall always be at each dwelling a receptacle for offal, and by refusing to remove ashes with which offal has been mixed, that species of filth is in a measure kept out of the ash-barrel; an attempt is also made to keep out such substances as go under the general name of rubbish, by providing other ways of removing them.

Every spring, at ordinary house-cleaning time, it is advertised in the newspapers that during a certain week the carts of the Health Department will carry away from dwellings any rubbish or house dirt that the inmates desire

to get rid of. A printed notice is also left at every house, specifying the day on which it will be visited. This is good, so far as it goes; but the trouble is that such rubbish is constantly accumulating and cannot be kept till the next spring. When a bottle is broken, an oyster or preserve can emptied, a piece of matting worn out, or a pair of boots discarded, it is desired to be rid of them at once; and in the heart of a city there is no way to get rid of anything except viâ the ash-barrel. On an average fully one-third of each cartload of so-called ashes consists of other refuse.

Portions of this refuse are harmless enough, as for instance, broken glass and crockery, plaster, old iron, and tin-ware, but other portions entirely destroy its suitability for filling, such as bones, hair, leather, rubber, paper, pieces of cloth or carpeting, old baskets, and in short, any vegetable or animal matters liable to decompose. Nearly all small animals that die in the city find a grave in the ash-barrel. How else can they be disposed of? There are not enough of them to deal with separately, and if they are thrown into the streets at night, they must be picked up by the first ash-cart and buried at the dump.

The ashes and house dirt are used to level up streets and parks belonging to the city, and private lands when desired or permitted by the owner. In a few cases a small sum is paid to the city for the filling. It is evident that the presence of the refuse house-dirt renders the ashes undesirable for street-building, for the mass as a whole compacts very slowly and continues to settle for years. If the surface be paved or covered with gravel, there will probably be no smell; but digging trenches for laying gas and water pipes, sewers and drains, will be an offensive operation for a number of years, since organic matters kept from a free supply of oxygen decompose slowly. The use of such filling for grading open squares and pleasure grounds is not especially objectionable, except as it may cause offence while being deposited. To support vegetation it must be covered several feet deep with earth and loam, and the trees and plants quickly assimilate and destroy the products

of decay. Frequent nuisances have been created by attempts to fill park lands on the borders of the sea. Salt water attacks the refuse matters and liberates foul-smelling gases. Enough sulphuretted hydrogen has been generated from half an acre of dumping-ground to discolour in a few hours the white paint of all the neighbouring houses.

Excavations made in Boston in land filled from city carts ten years previously have disclosed remnants of organic matter and the process of decomposition still going on. The cost of labour in removing ashes and house dirt during the year amounted to £20,300. Fully two hundred people find a livelihood by spending the day at the different dumping-grounds, raking over the loads of dirt as they are dumped from the carts, and collecting in bags and baskets such portions as can be sold to junk dealers.

Large animals, such as horses and cows, are disposed of by a contractor, who removes them for the privilege of possessing the carcase. When such an animal dies, the police send word to the Health Department, and the contractor at once despatches a cart for the body. It is taken to an island in the harbour, where every portion, it is said, is utilized, and the operation is very remunerative. It should be so, for it is also very offensive, and proper precautions not being used, the stench arising from it is carried by certain winds three miles to the city.

One hundred and eighty-five miles of paved streets are swept and cleared each week, some daily, others twice a week. Macadamized streets are not swept, as it is considered by sweeping off sand and detritus their durability is much lessened; but their gutters are cleaned as required, and rubbish is picked up. The work is all done by daylight. Streets are watered before sweeping by six watering-carts. The dirt is swept to the gutters by men with birch brooms, and is thence shovelled into carts. Thirty men in all are thus employed. There are besides, in use, nine one-horse sweeping machines, having a revolving brush, each doing the work of eight men and at less cost, but they cannot clean corners and depressions as brooms can. One

hundred and seventy men in all, of whom eighty-two are sweepers, are employed in cleansing the streets. Asphalte is most easily cleaned ; next, granite pavement. During the year, 48,059 cartloads of dirt, of 40 cubic feet each, were collected and disposed of to fill land for streets, parks, and dwelling lots. Occasionally a load is of a sufficient manurial value to be sold for a small sum. The street refuse is uniformly composed of earth, road detritus, fragments of wood, leaves, paper, soot, hair, &c. It is manifestly an unfit substance for filling, but what also to do with it is a problem yet unsolved. The cost of street cleansing during the year amounted to £17,346.

For cleaning street catch-basins, forty-three men and fourteen waggons are employed. The sludge is hoisted by means of buckets and deposited in close covered wagons, in which it is carried to the dumping-ground and covered with ashes. Last year 8766 loads were collected at a cost of £2700. The sludge has absolutely no value. Vaults and cesspools, from five to six thousand in number, are cleared by contract by means of odourless excavators, at a charge of from 25*s.* to 33*s.* per load of 80 cubic feet, paid for by the householders. The excavators are air-tight, and draw the contents of the vault by the suctional force of a vacuum. The gases are destroyed by passing through a charcoal furnace as they are pumped out. Not more than one load in ten can be sold for manure.

In conclusion, it may be taken that the scavengering of Boston is, upon the whole, satisfactory. Sufficient money, amounting in 1878 to about £71,000 is appropriated for the purpose, and is well and efficiently laid out. The labourers do their work well, being used to it, and knowing that faithful work ensures continued employment, the removal and disposal of offal is satisfactorily performed. The removal of ashes, house-refuse, street-sweepings, and catch-basin sludge is satisfactory, but the disposal of these matters is not satisfactory. It is experienced that certain portions of city scavengering may be satisfactorily performed by contract, under good regulations, strictly enforced.

Scavengering in Calcutta.

The house-refuse has been by long-prevailing custom deposited in the streets at all hours. The obvious inconvenience of this practice led, in 1881, to the restriction of the time during which house-refuse may be deposited in the streets, from 12 A.M. (midnight) to 7 A.M. The carts commence removing refuse at 5 A.M. To those who desire it, the corporation provide corrugated iron dust-bins, of $12\frac{1}{2}$ cubic feet or 16 cubic feet of capacity, at a charge of 18*s.* or 22*s.* respectively, with a little extra for brick-work stands.

The house-refuse with the road-scrapings and sweepings are conveyed out of town by the Municipal Railway to the Salt Water Lakes, where a square mile of area has been enclosed and reclaimed for the reception of all refuse. During dry weather this work is under complete control, and easy of performance; the unloading of the waggons and the levelling of the refuse can be and are carried on simultaneously, and what is of no little importance to the coolies, the work can be done in a comparatively leisurely manner without compromising the efficiency or conservancy of the town; the refuse is dry, light, and comparatively free from smell, and coolies may be had in any numbers. A few days' rain, however, is sufficient to alter the aspect of affairs altogether. The refuse suddenly increases in bulk and in weight; every waggon is in requisition at the town-platforms, and pressure has to be put on the coolies at their ultimate destination to unload them quickly. The coolies have then to work to the utmost of their strength without a moment's respite, and their discomfort is further increased by the heat of the fermenting refuse, which is not unfrequently so great as to make it impossible for them to walk on it. As a natural result, the refuse is carried a few feet only away from the waggons, and there thrown down and left to be picked up and carried out to contract distance when the weather is dry again. These drawbacks appear in their most intense form during the rainy season,

when the quantity of refuse reaches a maximum which never varies, while the condition of the refuse, when it arrives at the lakes, makes it increasingly difficult from day to day to handle it.

In the waggons the refuse is steaming hot ; under foot it is sodden, and the coolies sink into it knee-deep, and, though inured to bad smells as they necessarily are, they find the stench gradually becoming unbearable. It is thus not surprising that the coolies fall ill, and eventually desert in large numbers for better work, and those who remain have to be bribed to do so by higher wages and all kinds of indulgences.

At this juncture the idea of carrying sweepings to a distance has altogether to be abandoned, and the raking of the stuff out of the waggons and clear of the rails is all the coolies can be got to do. This goes on fairly well until the heaps of refuse thus raked out of the waggons become too high at every point of the line, and then a collapse is sure to be the result. Utter collapse has barely been prevented by the provision of three new branch lines, an extra length of rails in extension of the channel embankment line, and the running of night trains. Great strain has been put upon all the powers of the establishment, intensified by the apprehension of fatal disorder in the town.

The cultivation of the land reclaimed by the deposit of sweepings at the Salt Water Lakes is done by contract. All the conditions of soil and manurial strength are excellent. The cultivation during the early part of the year was limited to the growing of various kinds of oil-seeds and indigenous vegetables on the raised land, and the carrying out of surface improvements, such as the levelling of the land, and the picking out of potsherds, stones, and the like hard matter from the soil. During the rains the high lands yielded abundant crops of reana and impey, cucumbers, beet-root, carrots, ground-nuts and numerous varieties of "saugh." The nursery of fruit-trees flourished, but required close fencing and vigilant watching to protect it from the inroads of the wild pigs and scavenger

birds with which the locality abounds. The favourable result of his experimental efforts in regard to the cultivation of potatoes, yams, and the widely used indigenous tuber known as "notashah" induced the lessee to risk their cultivation on a larger scale, only to invite wholesale destruction by rats underground, and by birds and wild beasts above ground. Tobacco has also proved a failure; for, although the leaves grew very large, they were without strength. The lessee attributes this rank growth to the over-stimulating character of the newly-formed soil, and confidently looks forward to better results in future years when the soil will have had time to mellow.

The annually increasing quantity of refuse removed from Calcutta to Salt Water Lakes is evidenced by the following for four years:—

	Waggon-loads.
1878	7,284
1879	8,011
1880	10,016
1881	11,197

Besides the 11,197 waggon-loads of refuse, weighing 73,000 tons, conveyed in 1881, 550 tons of offal from slaughter-houses were also conveyed.

APPENDIX A.

59. And be it further enacted, that it shall be lawful for the commissioners, trustees, or any other persons having the control of the pavements in the streets, or public places in any parochial or other district within the jurisdiction of this Act, and who by any local Act or Acts of Parliament relating thereto are also authorized and empowered to direct the cleansing of the streets or public places, within such parochial or other district, at any time or times hereafter, to agree by private contract or by public auction, or by tender or proposal if they shall think fit, for any time not exceeding three years, with any person or persons to be the scavenger or scavengers, raker or rakers, cleanser or cleansers of the streets and public places within the said parochial or other district, and such person or persons, on a certain day in every week, and oftener when thereunto required by any three or more of the said commissioners or trustees, or other persons as aforesaid, or by the surveyor of the pavements of such parochial or other district, or any inspector or other officer or person appointed by them or any of them, shall bring or cause to be brought convenient carriages into all such streets or public places where such carriages can be drawn near or pass unto and at or before their approach, by bell, horn, clapper, or otherwise by a loud noise or cry, shall give notice to the inhabitants, and shall give the like notice in every other place into which the said carriages cannot pass and abide, and such scavengers, rakers, or cleansers shall take and carry away, or cause to be taken and carried away, from the respective houses and premises of the inhabitants or occupiers, their soil, ashes, cinders, rubbish, dust, dirt, and filth, and all which the said scavengers, rakers, or cleansers shall carry away or cause to be carried away at their own cost and charges, upon pain of forfeiting a sum of 40*s.* for every neglect or default (except nevertheless all such rubbish, earth, dust, and filth as shall be

Commissioners &c. may appoint scavengers.

occasioned by building, repairing, amending, or altering any house or houses, or any other building or buildings, or by cleansing or repairing any drain or sewer) and also that the said rubbish, earth, dust, or soil, thereby occasioned, and every part thereof, within the space of twelve hours after the same or any part thereof shall be first left or placed in any street or public place, shall be carried away by or at the charge of the owner or owners, occupier or occupiers of such houses and buildings, or by the commissioners of such sewers respectively as aforesaid, and that such owners, or occupiers, or commissioners neglecting to remove the same, and every part thereof, or to cause the same to be removed within the time above limited, shall forfeit and pay the sum of £5 for every neglect to remove the same within the time above limited; and also that if any person or persons shall refuse to permit such other soil, ashes, cinders, rubbish, dust, dirt, or filth to be taken away by the scavengers, rakers, or cleansers, or other persons appointed by and agreeing with the said commissioners or trustees, or other persons as aforesaid, then every such person or persons so offending shall in like manner forfeit and shall pay the like sum of £5. Provided always, that it shall and may be lawful to and for the said commissioners, trustees, or other persons having the control as aforesaid, either to contract and agree with and to appoint the same person or persons, or a different person and other persons, to be the scavengers, rakers, or cleansers within their parochial or other district, of the streets or public places therein, and to be the persons to collect and carry away and possess and retain the soil, ashes, cinders, rubbish, dust, dirt, and filth from the houses and premises within their respective parochial or other districts, as they shall deem most expedient; but that the right and benefit of such soil, ashes, cinders, rubbish, dust dirt, and filth shall belong exclusively to the person or persons who shall be from time to time by the said commissioners or trustees, or other person as aforesaid appointed to collect and possess the same; anything in any local Act or Acts of Parliament or in this Act to the contrary, notwithstanding.

Dust to be removed only by scavengers so appointed.

60. And be it further enacted, that if any person or persons, other than the scavengers, rakers, or cleansers of any parochial or other district, or the other person or persons employed or appointed by or contracting with the said commissioners or trustees, or other persons as aforesaid to collect and retain the dust, cinders, or ashes within their respective parochial or other district, or those employed by and under such person or persons,

shall on any pretence whatsoever go about to collect or gather, or shall ask for, receive, or carry away any dust, cinders, or ashes,* it shall and may be lawful for any justice of the peace for the city, borough, or county within which such parochial or other district may be situate, upon complaint to him made, to grant a warrant to bring before him such offender or offenders, and also for any person or persons who shall see any such offence committed to seize, and also for any other person or persons to assist in seizing the offender or offenders, together with the horses, asses, cattle, carts, trucks, wheelbarrows, or other carriages, or implements made use of for carrying the same away; and by the authority of this Act and without any other warrant, to convey him, her, or them before such justice of the peace, or any justice of the peace for the said city, borough, or county; and such justice shall, and he is hereby authorised and required to examine upon oath the person or persons apprehending such offender, or offenders, and any witness or witnesses who shall appear to give information or evidence touching such offence; and if the party or parties shall be convicted of going about to collect or gather, or of asking for, receiving, or carrying away any dust, cinders, or ashes from any house or other premises within any parochial or other district within the jurisdiction of this Act, not being the person or persons employed or appointed by or contracting with the said commissioners or trustees, or other persons having the control of the pavements within such parochial or other district to collect and possess the dust, cinders, and ashes from the houses and premises therein, or not acting with or under his or their authority, he, she, or they shall respectively, for the first offence, forfeit and pay the sum of £10; for the second offence the sum of £15; and for the third and every subsequent offence, the sum of £20; and one moiety of which respective penalties shall be paid to the informer or informers, or to the person or persons who shall apprehend the offender or offenders, and the other moiety shall be paid and shall belong to the person or persons so employed or appointed by or contracting with the said commissioners or trustees or other persons as aforesaid, and if such offender or offenders shall not on conviction pay the said penalty or penalties, such justice is hereby required to direct such horses, asses, cattle, carts, trucks, wheelbarrows, or other carriages or implements which shall have been so seized, to be appraised

* Ashes from a brass founder's furnace containing particles of metal, not "dust, cinders, or ashes" within this section, Law *v.* Dodd, 17 L.J. M.C. 65.

and sold; and after deducting out of the moneys to arise by such sale the penalty or penalties incurred, together with the reasonable charges and expenses of such warrant, and of such distress, appraisement and sale, the overplus thereof shall be returned upon demand to the party or parties whose horses or other things shall be appraised and sold; and in case there shall have been no seizure as aforesaid, or if the horses, asses, cattle, carts, or other things which shall be appraised and sold shall not produce a sufficient sum of money to pay the said penalty or penalties, charges, and expenses, then if such offender or offenders shall not upon the conviction pay the said penalty or penalties, or such part or parts of the said penalty or penalties, charges and expenses which shall remain over and above the produce of the horses, asses, cattle, carts, and other things so seized and sold, then such justice is hereby required to commit such offender or offenders to the common gaol or house of correction for the city, borough, or county where such parochial or other district shall be situate, there to be kept to hard labour for any time not exceeding thirty days, unless such penalty or penalties, and charges and expenses, and every part thereof, shall be sooner paid and satisfied.

On the neglect of scavengers to remove dust for seven days, the dust may be removed by any other person.

61. And be it further enacted, that in case such person or persons so employed or appointed by or contracting with the said commissioners or trustees or other persons for the purposes aforesaid, shall neglect for the space of seven days to bring or cause to be brought carts or proper carriages into all the streets or public places as aforesaid where such carriages can pass, and to give notice in manner aforesaid to the inhabitants of their coming, for the purpose of taking away such dust, dirt, soil, rubbish, filth, cinders, and ashes, and to give the like notice in every place into which the said carts and carriages cannot pass, or to take away and remove all such dust, dirt, soil, rubbish, filth, or cinders, or ashes from the houses and premises of all and every the inhabitants of such streets or public places, or from such part or parts of such houses or premises where such dust, dirt, soil, rubbish, filth, cinders, and ashes shall be deposited, that then (after twenty-four hours' notice given to such person or persons so employed or appointed by or contracting with the said commissioners or trustees or other persons for the purposes aforesaid, or left for him or them at his or their usual house or houses, yard or other premises, requiring him or them to bring or cause to be brought carts or carriages to take away their dust, dirt, filth,

cinders, or ashes, and to take away and remove the same from their respective houses and premises), it shall and may be lawful for such of the inhabitants of such of the said streets or public places, who shall have given such notice as aforesaid, to give away or to sell their dust, dirt, filth, cinders, or ashes to any person or persons whomsoever; and that such person or persons who shall take and carry away the said dust, dirt, filth, cinders, or ashes, shall not be subject or liable to any penalty or penalties for so doing upon every such neglect; anything in this Act or in any local Act or Acts of Parliament contained to the contrary thereof notwithstanding.

FIRES AND FIRE BRIGADES.

BY

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IN ancient days, and almost until our own time, it was supposed that there were four elements—air, earth, fire, and water; but a more careful study of the subject has resulted in withdrawing fire from the category of elementary bodies, and classifying it among the accidents or combinations.

Fire consists of a combustible substance and a sufficient amount of heat, and the combustible substance is again divided into the visible object, whatever it may be, and a certain proportion of air, which is generally termed a supporter of combustion. It is not necessary to go further on this point, though it may be stated in general terms, that it is only one-fifth of the ordinary atmospheric air, namely, that part known as oxygen, which is necessary in order to cause fire.

It is sufficient for the present purpose to indicate briefly, that fire is combined of a combustible substance, a supporter of combustion, and a sufficient amount of heat, and that if any one part of this triple combination be removed, the fire must cease to exist.

The business of firemen is to bring about this removal,

and, when stated as a definition, it seems exceedingly simple, though a closer study of the subject will show that the process of disintegrating the component parts is sometimes much more difficult than that of placing an extinguisher over a candle for the same purpose.

A complete investigation of this subject embraces so many branches of technical study, that it is a somewhat difficult task to produce a summary or condensed account of it which will satisfy readers who desire only to hear something about it, as distinguished from those whose duty it is to master it in a practical way; and there must be considerable room for doubt whether the wisest course has been adopted in selecting for the task one who has spent long years in the serious labours of the profession. Every effort will be used to justify the compliment which doubtless was intended by this choice; but circumstances and habit may prove adverse, and it is earnestly hoped that allowance will be made, and some forbearance shown, if here and there a few technicalities burst forth from their imprisonment and show their unwelcome presence on the surface.

A fireman, who has sedulously devoted himself to the necessary study and labour and has made any fair success, may well be proud of his profession; but he must never forget that he has colleagues in his work—the architect, the merchant, the manufacturer, the designer, the mechanic, the chymist, the electrician, the hydraulic engineer, and last, though by no means least, the population, whose care or want of care most seriously affect the general result.

Sometimes a fireman may give the foremost place to one of these, sometimes to another, sometimes perhaps to himself, if he is somewhat unwise and inordinately vain; but there can be very little doubt that in the great centres of commerce and manufacture and population, the general condition of the place with regard to its safety or danger from fire depends on many causes which are inextricably mixed together. Unless the architect erects good buildings, the merchant puts into them a safe stock, the manufacturer takes constant thoughtful precaution in his work,

the designer prepares and the mechanic constructs suitable appliances, the chymist devises measures to guard against spontaneous combustion, explosive compounds, and inflammable vapours, the electrician furnishes means of rapid communication, and also (as may be hoped in the very near future) a mode of safe lighting, the hydraulic engineer supplies water, and the population takes reasonable care to prevent fire, and, when it does happen, to send quickly for help; unless all these carry out to some extent their several functions what can the fireman do? It is true that in most of the cities of the Old World, and notably in some of the largest, he has to fight against neglect in all these points, and there he is no doubt at disadvantage; but he knows the dangers thoroughly and does not fear them, and this is something. The public also know them in their own way—in many cases exaggerate them—and when a disaster happens, are not in the habit of blaming the firemen, and this also from a certain point of view is most important.

An effort will be made to touch on the most prominent of the points which go to make up this combination, but not to dwell on them more than is necessary for the purpose of giving the unprofessional reader a general idea. Those who want to know more—to go below the surface—can easily satisfy themselves by looking over some of the present writer's works, which, except to practical students, form perhaps some of the dreariest literature to be found in any language.

As already said, every effort will here be made to touch on the several points; but, before going further, it must be frankly stated that there will be no detailed allusion to the romance of the profession or the personal courage of those engaged in it. There is some romance in every kind of active life; but this is chiefly known to the spectators, not to those who have to do the work. Courage can be found everywhere; but it varies much, and a complete analysis of it would require an essay to itself. Two men may do the same act, perform the same feat at the same time, under circumstances precisely similar in every respect, and yet

the measure of their courage may be widely different. One does it in the stern discharge of duty, thoroughly knowing the danger, but not flinching; the other under an influence which may be called excitement, knowing the danger only partially or not at all. To the ordinary observer both deserve equal credit; but viewed by the light of practical experience the difference between the two is great. This is one of the numerous pitfalls in the way of a beginner, and unhappily there are many cases of weaklings tumbling in, never to rise again.

On the other hand, the strong occasionally avoid doing publicly something which they know ought to be done, which though dangerous they are not afraid to do; but they avoid it all the same, in order that they may not seem to act for the sake of mere applause, which they consider worthless and despise accordingly. Thus it will be observed that in the fierce light that beats on an unfortunate fireman a second kind of courage is required. Most of his work is necessarily done in public, and, if he wants to do it well, he must show moral as well as physical courage; in short, he must harden his heart and act as if no one were looking on. The true test of a good man is that he looks for approval only to his own superiors and his comrades, and takes the applause of spectators at its real value, as a mere expression of personal kindness and appreciative gratitude for the performance of labour under difficulties.

How good the crowds are to firemen in this way can hardly be known to those who have not often seen them, and he must be something more or less than a man, who could withhold his thanks from them at the proper time and place; but while the fire is going on, he must remain unmoved. Indeed, one of the truest tests of a brigade, as of a man, is that during a fire it takes no notice of what is happening in the crowd, and proceeds in silence, with vigorous determination and tenacity of purpose, until the work has been completed. How differently the fire brigades of the world would come out if tried by this

simple standard, may be left to the reader's imagination. It cannot be investigated here, as a promise has already been made to avoid the subject of personal bearing, of which this forms an essential part, and indeed an apology is due for venturing even these few remarks on one of the most tempting themes which can be presented to the thoughts of any one engaged in dealing face to face with men under circumstances requiring quickness, accuracy, intelligence, and absence of fear.

How fire brigades vary in outward appearance is probably obvious to every one who has had an opportunity of seeing many. The engine-houses, engines, means of communication, physique and uniform of the firemen, size and speed of the horses are different in different cities; but there is one point on which they differ more than all these, and that is their knowledge of the work. It has been said that there is as much difference between a man who has not cultivated and trained his intellect and one who has, as between a dead man and a living, and the same contrast may be made between those who have not studied fire brigade work and those who have.

Cities of considerable magnitude and vast commercial importance may be found in which the firemen, having had no real training, are without any of the necessary knowledge in the selection of their appliances, and are wholly dependent on the advice—the interested advice—of those who have appliances to sell. How they can justify their position to their employers or themselves, they perhaps could tell; but in many cases it appears to be somewhat analogous to that of some of the old crusaders, whose chief qualification, so far as their records show, appears to have been that at some time or other they had been "crossed in love," or met with some similar overwhelming misfortune.

Men can be found in charge of fire brigades in this and other countries who have many natural qualifications for the work, and who have laboured hard and mastered it; and such men have no cause to complain of the position which they hold among their fellow-citizens. On the con-

trary, all who see them at their work give them credit, sometimes even more than they deserve, for their knowledge, zeal, and skill, and will not allow any very harsh measure of censure to be dealt out to them even when they may not have altogether succeeded in some difficult task. Napoleon used to say that the best general was the one who made the smallest number of mistakes, and any fireman of long standing may be well content to be judged by the same negative standard.

But besides those who labour and take a professional pride in their calling, there are others in charge of fire brigades who have no apparent qualification and evince no desire to acquire any, and these have done much to lower the business in the eyes of the world. How they obtained their appointments, or why they are continued in them, may be known to themselves and their employers, though to no one else; but it is beyond doubt that many of them are absolutely in the hands of those who sell fire-extinguishing appliances, that they take commissions freely, and that the cities which they are employed to protect suffer accordingly.

Such men, of whom throughout the world there are far too many, have no real place among the working fraternity of firemen; they advance no cause; they acquire no skill; and, even when engaged in the active occupation of the business, betray themselves by the expressions they use, which are those of salesmen or shop-travellers, and not of firemen.

But how is the necessary knowledge acquired by any one? Is enthusiasm of any use? Is failure in other business a qualification? Consider another case.

A very young man on the side of a mountain obtains a view of the great ocean and is lost in admiration of its grandeur. While he watches, a glorious sight presents itself—a splendid vessel driving for a port with crowded sails before a heavy sea—and he thinks how great the man must be who has such a magnificent command, what a benefactor he must be to the world at large, and how all

who have the privilege to be near him must gaze on him with pride and loving envy. The young man in his enthusiasm rushes to the harbour, enrols himself as "a hand" on board the ship, and sails away to distant lands. Years roll by, and finally the ship returns commanded by this same young man—now no longer quite so young or so enthusiastic—but with the high ambition of his early youth fulfilled.

And now let it be considered by what means he reached this pinnacle of doubtful greatness.

His enthusiasm certainly helped him, as without it he would not have rushed down the mountain side and joined the ship; but there it stopped its services, and the command was finally attained only after long days and nights of monotonous toil and weary watching, under burning suns that boiled the pitch out of the deck, in fogs and snow, and sleet and ice, and lightning and thunder, and gales of wind that blew the canvas from the bolt-ropes and shook the vessel like an earthquake. He had got his reward, such as it was, and so was to be congratulated—perhaps envied—but it would be well for those who emulated his career to consider what the cost had been.

The same reasoning may well apply to those who engage in the business of extinguishing fires, which requires much labour and patience, and an amount of constant never-ending self-sacrifice from which many other professions may be considered almost free. The best advice which can be given to those commencing is to go slowly, avoid enthusiasm, watch and study, labour and learn, flinch from no risk in the line of duty, be liberal and just to fellow-workers of every grade, not only the humble but those in the highest places, who need liberality and justice most, take care not to wear the spurs before they are duly earned, and when they have been earned, wear them with humility, remembering always that those who have the largest experience in extinguishing fires, frankly acknowledge that they fall far below their own ideal. This is not intended as the language of discouragement; it is simply that of

practical caution, and, if rightly read, may keep many a youthful fireman clear of the pitfalls which beset the calling —and they are many.

The question of fires and fire brigades embraces a large variety of considerations, including the site and construction of buildings; storage of goods and merchandize; value of goods deposited; wealth or poverty of the place to be protected, which is quite independent of the value of the property, some of the largest depôts being used only for goods in transit; care exercised in classification of goods; inflammability of stock; accessibility of the premises; lighting, warming, ventilating, watching; appliances for extinguishing; staff employed in extinguishing; water supply; and many others.

With regard to the construction of buildings, there are regulations everywhere in force, all or nearly all based on that most splendid and perfect of laws, the Code Napoléon; all or nearly all in themselves good, and to a great extent similar, but in their operation varying considerably according to the capacity or honesty of the officials charged with their execution. In this point, however, marvellous differences are apparent; and in some places a thoughtful observer cannot but be pained and distressed at the quarrels and recriminations between those who control the construction of buildings and those charged with the protection of the same structures when completed and stocked with property.

The most perfectly constructed buildings in the world are perhaps those of France, especially in and about Paris, where gypsum and other materials useful for resisting fire are found on the spot, and therefore cost nothing beyond the expense of lifting; and this, which is well known to all firemen, became especially apparent during the terrible time of the Commune in 1871, when there was not as much as a single instance to be discovered of fire having passed from one house into another.

Many estimates have been made of the career and character of Napoleon Bonaparte, and there may be room

for large differences of opinion concerning some of his deeds which have become matters of history; but it would require a caviller of an unusually malignant type to find fault with that wonderful piece of building legislation connected with his name, which, whether acknowledged or not, has undoubtedly been for years the model for the world.

All over France it stands in its integrity, and it is well administered; in Germany, in Austria, in Belgium it is the law, and the law is carried out.

In Great Britain it is the basis of the building regulations; but somehow in this country the interests of individuals are occasionally allowed to hold rank with the so-called supremacy of the law.

In all these old countries, however, the proportion of buildings constructed on the excellent principles of the Code Napoléon is necessarily small, as the man was not born much more than a hundred years ago, and consequently arrangements have to be made for the protection of a majority of old bad buildings of the most dangerous and inflammable kind, especially in the great centres of commerce.

It is in the new large cities of America that the most perfect development of strong sound buildings may naturally be looked for, and not in vain.

For some forty or fifty years in all these great and thriving cities, that is to say, during the greater part of their existence, there have been Building Acts second to none ever made, even by the great Frenchman himself, and this is apparent to every traveller visiting them. The public buildings, the great hotels, the large warehouses, and other depôts of merchandize, cannot fail to strike a visitor with profound admiration of their form, material, and general solidity, which constitute a magnificent novelty—a splendid wonder.

But there is a reverse to this bright picture. In all these thriving, energetic cities of the West, there are what are called Commissioners for carrying out the laws,

and the Commissioners are paid by salaries. These gentlemen are members or supporters of the political party at the moment dominant, and they go in and out with their party, and share its fate and fortunes in every way, even to the extent, in some cases, of engaging in political campaigns, speaking on the hustings, and canvassing during their tenure of office.

That they know their business, or that some one connected with them knows it, there can be no room for doubt. Some parts of all the great cities of America compare most favourably with the Unter den Linden of Berlin, the great Ring of Vienna, the Boulevards of Paris, the Regent Street of London; but, notwithstanding this, constant and bitter complaints are heard of the imperfection of the general buildings. Whether these complaints, which unceasingly weary the visitor with their monotonous insistence, have any foundation in fact, or whether they result from ignorance or political malice it is impossible to judge; but it may safely be asserted that in no other country in the world would language of this kind concerning public officials be tolerated as that which is habitually used in America with regard to the Commissioners of buildings. The impression made on a traveller by the constant use of such language is, that it is certainly malicious, probably unjust, and possibly untrue.

It may be asserted without fear of contradiction that the part of Boston which was destroyed by the great fire of 1872 was so perfect in all the points which constitute safety from fire, that even in the beautiful capital of France itself, the model of cities, no space of similar magnitude can be found with sounder or better buildings, and very nearly the same may be said of the part of Chicago destroyed by the fire of 1871, and of large portions of other American cities.

That part of Boston has been since rebuilt, and it is perfect; but it is no better than it was before, simply because it is impossible that it could be better. The Americans have been wise in enacting good building laws; but they

hardly show the same wisdom in disparaging the efforts of their appointed agents to put them into execution.

The defects which can be found in the construction of buildings in this country are well known by those whose duty it is to witness the effect produced by fires, explosions, and catastrophes of a similar kind During recent years many of the regulations for the construction of buildings have been carefully revised, and the result of these revisions has been to produce better buildings; but very great improvements are yet required in our building laws in order to bring them up to anything like the French, German, or American standards.

It is impossible to enumerate here the many evils referred to; but space must be found to enter a protest against the too common practice of constructing buildings, such as institutions, schools, factories, &c., with only one staircase for the accommodation of their large number of occupants. The fact of having only a single means of escape, in the case of a panic alone, would lead to serious if not fatal accident, and, if a fire should break out on the lower levels in the proximity of the staircase, the result would be most disastrous, as the only mode of exit would be altogether cut off.

All such places as these should most certainly be furnished at each end of the building with a staircase giving access to the various levels.

No matter how stringently the clauses of a Building Act may be drawn, or however vigilantly its enactments may be enforced, if immoderate cheapness of construction is permitted, there will always be found ways to infringe the provisions of the law.

The system of inviting builders by means of advertisement to offer tenders for the construction of buildings is one very generally resorted to at the present time, and it has its advantages from certain points of view. When a judicious selection of the persons allowed to tender is made, the specifications and drawings carefully prepared by professional persons whose theoretical and practical

knowledge of the subject is thoroughly sound, the material used all of proper description, and the execution of the work carried out with a minute attention to all the details under the supervision of a skilful and honest clerk of works, no evil consequences could result; but this combination, so necessary for the perfect construction of a building, is not always to be found.

Tendering by unqualified persons is neither more nor less than a competition among builders as to who will work at the cheapest rate; and, unfortunately, it is too often the means of bringing forward ignorant, unscrupulous men, to the exclusion of those of honour and intelligence. Scamping is resorted to, either to increase the builders' gain or to save them from positive loss, as probably the price at which they have contracted to carry out the work is insufficient to enable them to supply good material and proper skilled labour.

Therefore taking soundness of construction as the true basis and fundamental principle on which the reduction of losses by fire depends, the system of contracting with builders, whose only recommendation is that they will carry out the work at the lowest cost, is certainly not calculated to attain the desired end.

This branch of the subject is of paramount importance to all persons engaged in commerce, and is of the deepest interest to those whose lot it is to be practically employed in extinguishing fires.

While there are many points on which firemen may probably differ, this is one concerning which all those who have had any experience will be found to be absolutely unanimous.

A most important consideration for fire brigades, as affecting their success in extinguishing fires, is the efficiency or inefficiency of their water supply.

The proper duty for firemen is to use water provided for them; but in the great progress of commerce, and perhaps the reckless or thoughtless action of municipalities and other responsible bodies, either no provision of water or

an imperfect provision is sometimes found, and consequently, in urgent and important cases, a fire brigade has not only to use the water, but also to provide it. This is not at all as it should be, but it frequently happens, and consequently firemen are compelled to learn all the means of obtaining water under difficulties, as well as using it.

Several contrivances have been brought forward at various times for the purpose of extinguishing fires, some professing to dispense with water or any other liquid, but most of them claiming that, by the introduction of certain chemicals into water a great reduction is made in the quantity necessary to be used.

In America chemical apparatus have been a good deal employed, and, according to the accounts given of them, with some degree of success. But, however this may be, it remains perfectly clear that the time has by no means arrived when water in its natural state can be considered at all likely to be superseded for extinguishing fires.

The abundance and ease with which water can generally be obtained, and the force with which it can be applied on the burning materials through the pressure induced by its own gravitation, or by fixed pumping machinery, or any movable pumping appliances, such as steam fire-engines, constitutes, at least for the present, the principal weapon for fire-brigade use in all large cities.

Water for supplying the requirements of cities is usually taken from lakes and rivers, and collected in large reservoirs and filter-beds situated in the most convenient and suitable parts of the high levels of the place; and the water is forced either by gravitation or pumping power into these receptacles, and from them distributed by means of mains, service, and supply pipes to the houses of the inhabitants, and wherever else it may be required.

In many of our provincial cities the water supply arrangements are vested in the municipal authorities, and in most of these cities all the mains and service pipes are kept constantly charged with a good head of water. In other cases, among which is that of London, they are in

the hands of commercial companies, which sell water to such of the inhabitants as choose to buy it.

In London there are eight different water companies, each supplying a separate district, except in a few parts, where over certain areas the mains of two companies run conjointly.

In all the principal streets and roads the large mains are, as a rule, charged with a constant head of water; but the amount of pressure varies according to the arrangements of the respective companies.

The houses receive their water through supply pipes from what are called service pipes.

The service pipes are connected with the mains, and the supply pipes are led from the service pipes into the houses. Stopcocks are placed on the service pipes at their point of junction with the mains, to control the inlet of water. The mains are fitted at various points with sluice-valves, and by closing some of these and opening others, as the circumstances of the case may require, a greater quantity of water can at times be directed to where it is specially wanted.

One of the greatest obstacles to a constant water supply being given in many parts of old cities, is the insufficiency of the leaden pipes and internal fittings of the houses to bear the pressure, and the consequent great waste of water.

Within that part of London known as the City there is a constant head of water, with a good distribution of hydrants in all parts, and the firemen can immediately on their arrival attach their hose. For moderate, or even large fires, nothing better can be desired, but in the case of very large conflagrations engines are required.

Many other parts of London have now a constant head of water, and wherever the pressure is sufficient to render them serviceable, hydrants have been laid down; but a considerable time must elapse, and many changes must be made, before it will be safe to dispense with the use of powerful pumping engines.

Indeed, no matter how plentiful the water-supply of a

city may be, or how great the pressure on the street mains, it will probably always be necessary to provide fire-engines for attending fires. The bursting of a street main or service-pipe may, at an important moment, remove the pressure requisite for forcing the water where required, and in such a case without fire-engines the firemen would be powerless. Besides this, excessive frost, accidents, or unforeseen contingencies of several kinds might at any time temporarily disable the water-supply, so that it would not be at all safe to place entire reliance upon it.

In London all the Water Companies provide water for fires free of charge, and make every effort to assist the Fire Brigade as far as lies in their power; but their arrangements are made for their own commercial purposes, and consequently they provide only as much as their customers wish to buy. Fortunately these quantities are frequently sufficient for the use of the Fire Brigade; but there have been many remarkable instances to the contrary, chiefly in certain districts covered by warehouses, where the ordinary consumption is very small, being, in fact, limited to the quantities required for drinking and washing.

The question of water supply is inseparably connected with that of fire protection, and it is treated in various ways, according to the special circumstances of several places throughout the world.

Taking alphabetically a few cities, the following results appear:—

Athens has its reservoirs about 100 feet above the mean level of the city, and there is a constant service with the whole of this pressure; but barrels of water are carried by the Fire Brigade, and it is only after these have been exhausted that the mains are utilized.

Berlin has a similar arrangement, with a constant head or pressure varying from 80 to 100 feet, but here also they carry barrels of water.

Birmingham has a constant service, with a pressure varying from 46 to 230 feet.

Boston, U.S., has a constant high-service, varying from

100 to 220 feet, and a large number of cisterns, or fire-reservoirs, under ground, from which the water can be pumped by fire-engines..

Bradford has a constant service, with a pressure of 184 feet.

Brooklyn has a constant head of 186 feet.

Chicago has a constant head of 130 feet, and a number of underground cisterns.

Cincinnati has a constant head, varying from 276 feet in the low-levels to 92 feet on the high, and also underground cisterns.

Constantinople has no regular water service, and is supplied only by fountains, and by cans carried on porters' shoulders.

Dublin has a constant service, with pressure varying from 149 to 173 feet.

Glasgow has also a constant service, the pressure varying from 69 to 207 feet.

Hamburg has a constant head, varying from 146 feet by day to 215 by night.

Liverpool has a constant service, the pressure varying from 10 to 220 feet.

London has partly constant and partly intermittent services. The pressure varies from a head of 20 to 200 feet, and the water from rivers and canals is used when fires occur in their vicinity.

Manchester has a constant service, the pressure varying from 46 to 230 feet.

Montreal has a constant head, varying from 57 to 149 feet.

Newark, U.S., has a constant pressure, varying from 44 to 100 feet, and a number of underground cisterns.

New Haven, Connecticut, has reservoirs with a constant head of 127 feet, and also some underground cisterns.

New York has a constant head of 130 feet.

Paris has two services, both under constant pressure, one with a head of about 30 feet, and the other about 120 feet; but the Fire Brigade also carry barrels of water.

Quebec has an intermittent pressure; the city is divided into six districts, and the water can only be turned into one at a time; the head when turned on varies from 46 feet in the high-levels to 228 feet in the low.

Toronto has a constant head of 216 feet.

Venice has nothing but the canals.

Vienna has a constant head of 138 feet, but the Fire Brigade also carry barrels of water.

This brief sketch will suffice to show that firemen in the present day have to study how to utilize in the best way imperfect supplies of water, and to make the best of difficulties arising from intermittent pressure, insufficient quantity, or the hydrants and plugs being too far apart.

The expression fire-proof is in such frequent use that a few words must be said concerning so-called fire-proof buildings.

Among all the clear and distinct expressions in this or any other language, it would be difficult to find one more completely separated from the whole region of doubt or misapprehension than the term fire-proof; and at the same time there is probably none more often misapplied or falsely used.

This misapplication or false use of words is one of the crying evils of our time, and if not suppressed, must sooner or later strike a fearful blow at the commercial interests of the country; for it is impossible to conceive any great interests permanently advanced by statements which are not literally and substantially correct, and incapable of being misinterpreted even by ignorant persons.

There seems to have crept in among us in the present day a loose or incorrect habit of thought, leading to expressions which, in their simplest and only real sense, are incompatible with the strictest truth, or to put it in the converse, as our enemies would do, there seems to be an absence of the spirit of truth, leading to expressions incompatible with correct habits of thought.

We allow in matters of commerce an extent of exaggeration amounting, in numerous instances, to positive false-

hood. Thus, for instance, advertising sheets abound in notices of such articles as frictionless blocks, sunlight-burners, and a thousand other kinds of manifest absurdities, it being of course known to every one who knows anything, that a block cannot be without some friction, and that a sunlight-burner means a gaslight-burner. These are very trifling instances, but they may be multiplied to any extent.

Again, it is impossible to look down a long column of advertisements of the same general class of articles sold by several different persons without finding a series of statements to the effect that each is the very best of its kind; and sometimes not only this, but an addendum, that all the others are impositions. These marvellous instances of latitude of expression seem by general consent to be admitted as what in fact they often, but not always, are—the outpourings of genuine enthusiasm and fixed belief on the part of their authors; but whether they can be so designated or not, there is always the great, old, universal law of *caveat emptor*, which tends to check the over-confiding, and so to keep things right.

Making, however, full allowance for the requirements of commerce, and the desire of interested or enthusiastic persons to proclaim the supposed excellence of what they have to sell, it must still be a matter of surprise and regret to all who think about it, that such laxity and latitude of expression should have been allowed to creep into our language, to take root there, and by degrees to grow and flourish, until, like some fertile noxious weed, they seem to spread on every side, choking alike the outgrowth and the natural development of our simple tongue, and even sucking the life-blood from our simple thoughts and simple words.

It is not too much to say that, if one wants now to hear things called by their simple truthful names, one must go to the very best houses of commerce; and even then, such is the poison of the noxious weed, it is not always certain that there will be no exaggeration amounting either to positive deceit, or at least to expressions calculated to deceive.

In the present paper, however, it is not intended to do more than point out the excessive laxity of expression which has led to the common use of the term fire-proof, as applied to a combination of substances, many of which are not proof against heat, and none of which are proof against fire. Indeed, to find any substance, or combination of substances, really proof against fire, in the true and simple sense of the words, is almost impossible. Certain it is that asbestos, the substance which most nearly of all approaches this quality, and which takes its name accordingly, wastes away very considerably under the constant application of heat.

There is much force in the saying of a well-known French author, "Allumez une fournaise autour des pyramides d'Égypte et vous en ferez de la chaux;" and, if it be true that a strong fire could turn the pyramids of Egypt into lime, how should those persons blush who talk so glibly of what they are pleased in the present day to term euphemistically fire-proof buildings.

It may possibly suggest some curious reflections to find a practical treatise on a subject of this kind commencing with a quasi-dissertation on the proper use of words; but it is hoped the reader will believe that this is done, not for the purpose of dipping into philology, or in any way departing from the text of the discourse, but simply as a necessary means of reaching the practical end in view by the safest and most straightforward course which presents itself—in this case the exposure, and, if possible, the demolition of a corrupt term, which has for years proved a stumbling-block in the way of true economy of construction, and was never more full of danger than at the present hour.

In short, the term fire-proof, as now employed, does not mean what the words which form it express; and even those who make it their trade or business to use the term, when called on to explain their meaning seriously, are obliged to confess that they use it only as a metaphor or figure of speech; and practically that is about the only

sense in which it can be used without departing from the truth.

To construct a building in such a way that it will resist the effects of heat and flame for any considerable time—for that is all that can be done—there are required care and forethought in the choice of the position, a sound knowledge of the several materials to be used, and a skilful design to bring these materials into combination in such a way as to meet the proposed requirements of the structure when completed, and at the same time to avoid the consequences of extreme and sudden changes of temperature, for it should be known that some of the greatest destruction ever seen after a conflagration has been caused, not by the primary, but by the secondary effects of fire—that is to say, not by the expansion produced by heat, but by sudden contraction after the expansion.

The necessary limits of this essay prevent a full discussion of all the numerous details involved in the choice of a position, including the consideration not only of the site proper, but also of the kindred subjects of foundation, area, configuration, and many others. We shall therefore pass on to the subject of choice of materials, in which there is much food for reflection in connection with safety of buildings when exposed to sudden changes of temperature.

In walls, bricks of any kind, but more particularly fire-bricks, if properly laid in sound mortar or cement, will resist the effects of heat for a very considerable time ; stone, if laid as well in the middle as on the inner and outer surfaces, lasts a long time, unless it fails in the unsupported parts over the openings, which it always does when the lintels and the tops of the windows are made of the same material.

Openings for doors and windows in a stone wall, to be safe, should be mounted on the top with brick arches, which would carry the load without any difficulty long after stone in such a situation would have become calcined, and probably allowed the whole of the superstructure to fall down.

For stairs stone is a very dangerous material, unless it is embedded on some substance which can carry it when it gets hot. Stone stairs are usually made by tailing in the ends of a number of blocks of stone a few inches into a wall, leaving some two or three feet protruding and hanging unsupported in mid air. After such stairs have been completed, they present an imposing appearance of solidity and strength, and so deceive the eye; but where is the man who would willingly trust his life to one such step if fixed alone at a height of thirty or forty feet above the ground? Even at the ordinary temperature of the atmosphere the block would then be somewhat fragile, but there can be no doubt that any sudden rise of temperature —such, for instance, as might be produced by pouring a kettle of boiling water on it, would suffice to bring it to the ground. In this case the exposed part would expand with the heat; the supported part, being protected, would not expand, and a fracture would occur between the two, generally close to the wall.

At a fire which took place in the basement of a private house a cupboard and some small articles of furniture were burned, and the fire was confined to the spot in which it originated. The stairs leading from the basement to the ground floor were of stone, and were separated from the basement by a door and partition both of wood, only half an inch thick in the panels, and this door and partition, though very much charred on the inside and blistered by the heat on the outside, were not burned through. No fire whatever reached the stone stairs, and nothing but heat from above or below; no water was thrown on them to cool them suddenly, and no draught of cold air from outside passed over them, and yet they were broken into fragments and totally destroyed up as far as the first landing, where they ended and the wooden stairs commenced.

Such are some of the principal dangers of the use of stone; but of all building materials there is none which requires more extreme care and delicate treatment than iron.

Let the reader imagine a straight iron rod, supported only at its ends, and capable at the ordinary temperature of the atmosphere of carrying a heavy weight in the middle. Let a strong fire be lighted under it, and what will be the result? In a few moments the rod will lose its straightness, first sagging in the middle, then dropping altogether, next fusing, and finally running away like so much melted butter; and yet this is a material which many persons persist in calling fire-proof, and in putting to carry loaded floors in buildings which they designate by the same inappropriate epithet.

There is no exaggeration whatever in the picture here presented, as any one can prove for himself with the assistance of a blow-pipe on a common fire of wood or coal; in fact, that is the way in which the experiment is ordinarily shown for purposes of instruction.

Who is there who does not know that a foundry and a blacksmith's shop are absolutely dependent on the fusing or softening of iron by means of heat, and that no column, girder, rivet, or any other piece of this metal, however large or small, can be fashioned for the place assigned to it in a building without having been previously subjected to the effects of heat? And yet, when it has been fitted into its place, some magic change is asserted to have suddenly come over it, which renders it no longer subject to the influences without which it could not previously have been made suitable for the work.

And now it may be asked, whether it is proposed that these dangerous materials, stone and iron, should never again be allowed in buildings; but the answer is distinctly in the negative. Nothing of the kind is proposed, or even ever so remotely suggested. The requirements of the time in which we live involve a necessity for the use of these materials; these requirements must be met, and no one with any pretence to being called practical can venture to ignore them.

What is proposed is simply this: that those charged with the construction of buildings should thoroughly ex-

plain the facts of the case to their employers in words incapable of being misunderstood.

It would be no particular humiliation to an architect or builder to have to inform his client that he has been obliged for economy, for convenience, or for whatever other satisfactory reason he may wish to assign, to use stone and iron in the construction of the building; that these materials look well, and afford many advantages for the transaction of business; that they may probably last a long time, and in the end prove very economical; but that there are inseparable from their use two dangers which should be ever present to the occupier's mind, and which should be guarded against in every possible way, the one frequent in occurrence but generally moderate in extent, the other happily rare in occurrence, but, when it does occur, in the last degree serious, and sometimes altogether overwhelming.

The first is the danger of a shock, the second, that of sudden change of temperature; and, if these points can only be impressed on those who build, and those who occupy buildings, this article will have done its work.

Nothing is needed but for those who have the knowledge to tell the simple incontrovertible truth to those who cannot know it without being told, neither deceiving themselves nor using language of a dubious kind, or of any kind which can be twisted into a meaning likely to deceive others. If this be done, the danger will be thoroughly recognised and understood, and it is hardly too much to say that, practically, when a danger of this kind is once really known, it is already half guarded against.

Suppose a ship to be sent to sea, the builder and owner both assuring the crew that she was properly found and able to stand any storm, but omitting to mention that she was fitted below water with a valve or sea-cock, which, however useful for many purposes, would require attention in heavy weather to prevent it opening. A storm arises; but before it has attained half its height, the vessel founders, and many lives and much property are lost. Who is responsible for such a loss? The builder and owner may

say that they have told the truth, as the vessel was properly found; but the crew may naturally retort, that they demur even to this, as they did not get an opportunity of testing it; that they had been told but half the truth, and that if they had only known the whole, they could have effectually guarded against the danger, and would certainly have had no fears or anxiety whatever on the subject.

It is earnestly to be hoped that the time is approaching when the constructors and owners of buildings destined to carry large quantities of heavy goods will recognize their responsibility to warn the occupiers, and those who labour under them, of all dangers which are inseparable from the use of such materials and form of construction as are adopted, and not attempt after a disaster to screen themselves under the plea, which may sometimes be used, but never with real fairness, that the building did not yield to the effects of fire.

Even where walls are made of sound well-burned bricks laid in best cement, what is their use, if some material inside, on the application of heat, fractures them or removes them altogether at the very moment when they are most required to stand firm? They are only as the findings of the supposed ship, which may or may not be very good in themselves, but get no opportunity of being fairly tested.

It must be strongly asserted that before a building can be fire-proof it must first be heat-proof, and that no building with any exposed metal forming an essential part of its construction can be truthfully so designated. Within the last few years a memorable example was afforded of the danger of iron columns:

A fire took place in a shop, the front of which was mainly supported by two wrought-iron columns. These became red-hot at an early stage, and without notice the whole front of the house fell in, killing one of the firemen whose duty it was to be at work beneath it. There is little doubt that had the supports been of solid oak, or other hard wood, this accident would not have happened.

Wherever iron is used it should be protected either by good brick-work, sound plastering, or if nothing better can be found for the purpose, solid wood-work round it. Wood-work, if really sound and solid, will resist for almost any length of time every possible effect of heat short of actual flame ; even when flame has reached it, it is by no means destroyed at once, but, on the contrary, is sometimes found to last for hours ; and wood protected on its under-side by proper plastering, which will not fall down or crack on the application of heat, seems to be a most powerful resister of flame. It is probably to the scamping now so common that we owe the diminishing use of timber as a material for the construction of buildings destined to carry heavy loads. Let this scamping only cease, let everything be as it represents itself to be, and either wood or some other heat-proof substance will be found to occupy a much more prominent part in the construction of our buildings than it does at present.

The contents of a building have undoubtedly much to do with its safety or danger ; but, in estimating the whole risk, the materials of which the building is constructed must never be put out of consideration. Every building cannot be erected with brick columns and groined arches ; but there is a vast range between these and the miserable cast-iron posts too commonly to be seen, many of which have been put in without having been tested for strength even at the ordinary temperature of the atmosphere, much less at that of a fire.

The following illustration may be given of a fact well known to all firemen of experience, but seldom proved to demonstration for those not specially interested.

A fire occurred in a warehouse of enormous proportions, and raged with great fury for five hours, at the end of which time it was extinguished, and a very large proportion of the building and its contents saved.

The warehouse was constructed of brick walls ; it had wooden floors, supported on wooden beams, which in their turn were carried on wooden story-posts about 12 in. thick ;

and, although serious damage was done, not one portion of the heavy woodwork was destroyed.

After the fire the proprietors allowed the chief of the fire brigade to remove one of the story-posts, with a section of the beams and other parts surrounding it above and below. This post had been subjected to the full action of the fire during the whole of its duration, as already mentioned, or, making full allowance for everything, including the delay of the fire attacking the particular spot on which it stood, and the time at which the cooling process commenced, certainly not less than $4\frac{1}{2}$ hours.

As large quantities of water had been used, and it was probable that everything had been saturated, the wood was carefully dried before a strong fire until not a trace of moisture remained in it.

It was then set on end in an open yard, exactly as it had stood in the warehouse, with the pedestal underneath, the cap above, and the beam across the cap; more than a ton of shavings, light wood, and heavy wood were placed round it, and after the whole heap was saturated with petroleum a light was applied to it; and, after this, large quantities of petroleum and turpentine were pumped on it.

At the end of $2\frac{1}{2}$ hours the post, beam, and other parts were withdrawn from the fire, and within a few minutes from the time at which they were withdrawn they ceased to burn.

A few feet were then sawn off horizontally at that part which had suffered most from the flames, and afterwards the same piece was split longitudinally with steel wedges, in order to examine its condition.

The post was of pitch pine, about the most inflammable wood known, and yet after exposure for seven hours to fires, the fury of which could not be exceeded except in blast furnaces, it contained within it a quantity of perfectly uninjured and apparently fresh wood, probably capable of supporting the whole weight which the original post was designed to carry.

Immediately after the saw-cut, and again after the

cleaving with steel wedges, the centre was carefully examined and found to be just perceptibly warm to the touch, but nothing more, thus proving that the fibre in which the strength lay was quite uninjured.

The lesson to be learned from this experiment is as follows :—

A massive story-post of even the most inflammable wood is absolutely and perfectly proof against any heat which can be applied to it, will not of itself burn at all, but requires a continual supply of highly inflammable substances to keep it burning, and, when this supply is withdrawn, ceases to burn ; and, lastly, after being exposed for seven hours to flames of very great intensity, cannot be injured to a greater depth than about two inches from the original outer surface, and will still show a centre as clean and fresh as when it was first put in.

There may be other materials suitable for this purpose which are capable of resisting the effects of heat ; and, if so, may one day become known ; but in the meanwhile those interested may perhaps be not unwilling to accept this strong practical testimony in favour of massive timber for the internal supports of heavily-loaded buildings.

Many inventions have been made of late years with a view of rendering wood and other building materials uninflammable. Some of these consist of a simple wash which can be periodically renewed ; others of a paint or paint-like substance which can be laid on with a brush ; others of a liquid impregnated into the interstices of the material ; and all these appear to answer fairly well when shown at exhibitions for advertising purposes ; but whether owing to the extra cost involved, the ignorant exaggeration of the advertising agents and exhibitors, or the apathy of the public, they have never been brought largely into use.

To give an imaginary, perhaps not altogether imaginary, instance of what is commonly done in this way : let an inventor be supposed to have discovered that a good wash of alum or of tungstate of soda dissolved in water will render wood and other substances uninflammable. He at

once advertises it as making the materials incombustible; a trial is carried out by skilled persons; the materials are consumed by fire; and the so-called invention is turned into ridicule; whereas, if he had only claimed for it what it could really do, or perhaps, to put the case in other terms, if he had only known the meaning of the words he used, and limited his assertions to the simple truth, he might have made a great success.

There can be very little doubt that the impregnation of timber and many fabrics used in furniture and for wearing apparel with dissolved alum or tungstate of soda, or the covering of many of them with certain paints, would render these substances uninflammable in the strict sense of the word: that is to say, they would not under any circumstances burst into flame, and this would be a great point gained.

Being combustible, they would of course be destroyed by fire in time; but then the time would be long, and an opportunity would be afforded for the inmates to escape, and under favourable circumstances, for external aid to come.

It is uncertain for how long a period the chemical impregnation would remain effective to prevent blazing up; but it is probable that if wood were saturated with the mixture once a year, this would be sufficient, and the season to be selected might be the middle of summer after several days of strong sun, when the timber is almost splitting with the heat.

There is another matter connected with the use of chemicals in this way which is worthy of attention, namely, the probability of their causing decay to the materials, and on this point different opinions prevail. Some say that chemicals bring on rot—chiefly dry rot—others say that they prevent rot. Both are equally violent in the expression of their views, and in fact, like all such persons, talk a great deal of unpractical jargon and semi-scientific nonsense. It may be stated, though not very positively, that so far as present experience goes, chemicals used in this way have no effect whatever either in producing or preventing decay.

In this country ceilings are made to look solid enough, and if they were only what they represent themselves to be, they would in most cases be almost impervious to the effects of either heat or flame; but let them be pierced through, and they are found to be a sham, being a mere skin of plaster adhering to some thin strips of wood, which may be termed indifferently laths or firewood, according to the taste of the observer. These strips are tacked on to the lower parts of the joists, and the spaces between them and the flooring-boards over the joists are simply so many flues, commonly containing only very foul and noxious air, but capable at any moment of being converted into most dangerous hidden passages for smoke and flame. Air passages are also found in the lath-and-plaster partitions between rooms, behind the skirting boards of rooms, and under the steps and behind the skirting boards of stairs.

All this is wrong in every way; it may be called by any name people choose, as such appears to be the custom of our time; but it is at best a gross deception, and the sooner it ceases to exist the better.

All sound building is more or less good building for resisting the effects of heat, as a neighbouring country shows us by examples worthy of being studied by those interested in the subject; and all scamping is dangerous, as unhappily our own country and many others are constantly showing us by examples equally striking, and still more worthy of our serious study.

It is earnestly to be desired that, as far as our buildings are concerned, there may be no more shams in either things or words. Poisons no doubt are useful, but we do not commonly label them as food, and put them into the hands of persons who cannot possibly know their qualities. Whether it is a less offence to hand over a building to a person necessarily ignorant of the quality of materials and the art of construction, and not only to withhold all information concerning the acknowledged dangers, but even to go further and lull him into a false sense of security by informing him, without any reference to the

all-important question of the stock which it is to contain, that the structure is safe from the effects of heat, it must be left to the reader to judge.

To conclude this subject as it began, it is once more asserted that the ordinary use of the expression fire-proof, without qualification, is wrong in the extreme, and should be discouraged by all alike, whether interested only in the true meaning of our words, in the dictates of common sense and prudence, in the true economy of the commercial interests of our country, or in all these points combined.

Men may use the term heedlessly or lightly, and perhaps when so using it they may do but little injury; but this is all that can be said, for when they come to use it seriously, they cannot deny that, as far as concerns the true meaning of the words composing it, they help to deceive or to mislead those unacquainted with the subject, encouraging in their minds a sense of security which has no real foundation, by attributing the quality of being proof against the effects of fire to buildings which are not certain to be able to resist even the effects of heat without the contact of fire.

This is plain speaking, but it is necessary for some one to speak plainly, when thousands of lives and millions of money are in constant unnecessary peril through the careless, erroneous, deceitful, or false application of such a term as fire-proof.

This brief and imperfect essay would be still more incomplete without some reference to that process commonly known by the strange and somewhat unmeaning term of spontaneous combustion. If prepared shavings are laid in a grate with wood and coal over, and a lighted match is applied to them, the natural expectation is that they will burn, and this is called ignition or combustion; but, if certain other materials are placed in contiguity, which are perfectly well known to take fire in such a position without the intervention of a light, it is the custom to call the result spontaneous ignition or combustion.

Some years ago experiments were made with the view

of giving greater precision to the existing knowledge of the kindling of cotton or other open combustible materials which happen to have imbibed animal or vegetable fatty oils. Instances were given of olive oil igniting upon saw-dust; of greasy rags from butter, heaped together, taking fire within a period of twenty-four hours.

The danger of fire from this cause is familiar to those manufacturers who coat any textile fabrics with varnishes containing drying oils, and also to turkey red dyers, from the olive oil employed in their process.

Generally, this combustion may take place in intervals varying from a few hours to several weeks, when considerable masses of lamp-black, tow, linen, paper, cotton, calico, woollen stuffs, ships' cables, wood ashes, ochre, &c., are slightly soaked in oil and packed in such a manner that the air has moderate access to them. Nevertheless there is great vagueness about the exact conditions in which actual ignition of the mass would take place, what size of a heap might be necessary, and the various powers of different oils to produce this result.

The ignition of heaps of the materials under discussion has been often observed to be greatly favoured by a slight warmth, such as the heat of the sun. This is a very important observation, and it should be mentioned that the first experiments were made at a temperature of about 170° Fahr., and others at a heat a little over 130°, or about the temperature a body acquires by lying perpendicular to the sun's rays. The former temperature might represent the heat attained in the neighbourhood of a steam-pipe, a heated flue, or in front of an open fire.

A handful of cotton-waste, after being soaked in boiled linseed oil, and having the excess of this removed by wringing, was placed amongst dry waste in a box 17 inches long by 7 inches square in the ends. Through a hole in the cover of this box a thermometer was passed, with its bulb resting amongst the oily cotton, when the mercury began to rise rapidly, viz., from 5° to 10° every few minutes, and in 75 minutes from the time the box was placed in

the chamber, the heat indicated was 350° Fahr. At this point smoke issuing from the box revealed that the cotton was in a state of active combustion, and when a free access of air was allowed it burst into flame.

In another similar experiment the temperature rose more slowly, but reached 280° Fahr. in 105 minutes, when, from the appearance of smoke, it was plain that the cotton was burning, and the whole mass on being placed in a current of air was soon in a flame.

On a smaller scale a quantity of the oiled cotton that just filled a common lucifer match-box was tried, and within an hour it was on fire, the temperature of the chamber being 166° Fahr.

Raw linseed oil does not, as generally supposed, so readily set fire to cotton as the boiled oil; but in two experiments where the size of the box employed was $6\frac{1}{4}$ inches long by $4\frac{1}{4}$ inches square in the ends active combustion was going on, in the one case in five, in the other in four hours.

Rape oil, put up as in the first experiment, on boiled linseed, resulted in the box and cotton being found in ashes within ten hours. In another experiment with this oil and raw linseed, in a chamber kept at about 170° Fahr., the cotton at the end of six hours had not ignited. With the five following oils 130° Fahr. was the temperature employed. The quantity of waste used was loosely packed in a paper box holding about the sixteenth part of a cubic foot.

Two trials made with Gallipoli olive oil gave closely similar results, in one case rapid combustion occurring in a little more than five, and in the other within six hours.

In the case of castor oil, the oxidation proceeded so slowly that only on the second day the interior of the box was found to be a mass of charred cotton. The specific gravity of castor oil, ·963, is remarkably high, and its chemical nature very distinct from the other vegetable oils tried, which, no doubt has some intimate connection with its small heating power.

Three oils of animal origin were tried, with effects very distinct and instructive. Liquid lard, an oil of an ordinary specific gravity, viz. ·916, produces rapid combustion in four hours; sperm oil, which has a specific gravity of only ·882, and is not a glyceride, showed its unusual chemical character by refusing to char the waste; seal oil, which has a strong fish odour, not unlike that of the sperm, but a specific gravity of ·928, produced rapid ignition in 100 minutes.

Comparing raw linseed with lard and seal oils, it would appear that the statement is not altogether correct that drying oils are more liable to spontaneous combustion than non-drying oils. There is also some reason to believe that the rate at which oxidation takes place does not chiefly depend on the presence of small quantities of azotized or other easily putrefiable matters, but rather on the particular olein, or liquid fat, they contain. However, further inquiry on this point is necessary.

At least two experiments were made with each oil, and remarkably uniform results were obtained. The ignition of the cotton can be calculated on for any oil with about the same certainty as the point at which sulphur or other ordinary combustible material takes fire when heated in the air. So that the term spontaneous combustion may be objected to for the same reason that Gerhardt objects to "spontaneous decomposition" produced by oxidation.

The heavy oils from coal and shale, being chiefly the higher olefines, have a remarkable effect in preventing this oxidation, undoubtedly by giving a certain protection from the air. Mixtures of these oils with twenty per cent. rape, gave no indication of heating whatever at 170° Fahr.; and even seal oil, with its own bulk of mineral oil added to it, did not, when placed in a chamber heated to 135°, reach a temperature sufficient to char the cotton.

Without entering into the several details of scientific and technical interest, these experiments seem to show that all the oils enumerated above, with the exception of mineral and sperm oils, cause cotton-waste to burst into flame, or to

become a charred mass in the course of a few hours when exposed in a box to a heat no greater than what could be caused by the full absorption of the sun's rays on a summer day, or such conditions as could easily be attained by a mass of cotton-waste lying in the vicinity of a steam-pipe or open fire.

In some cases the rapidity with which combustion took place was very remarkable, and in all the experiments complete charring occurred in less than ten hours, except when mineral or sperm oil was used.

It has been commonly supposed that the drying oils are more liable to spontaneous combustion than the non-drying oils, but, as already stated, the results with olive and seal oil do not seem to support the notion so long prevalent.

The importance of the experimental results in regard to the use of oils in jute and woollen manufactures can scarcely be exaggerated.

Under the notion that olive oil is safer in regard to non-liability to ignite spontaneously than other oils, it has long been the practice of Insurance Companies to charge much heavier premiums to those woollen manufacturers who use oil other than olive oil; and with the idea of olive oils being the safest and best oil for their purposes, many of the woollen people to this day rigidly confine themselves to its use. From these experiments it would appear that other oils are at least equally safe, and perhaps much safer than olive oil, for their purposes.

With regard to jute works, the use of mineral oil for batching is a question of great importance to the economical conducting of the manufacture, and it is very satisfactory to see that a mixture of seal oil and mineral oil in equal parts actually refuses to char or ignite under the conditions mentioned, whilst seal oil used alone bursts into flame in two hours.

It would appear, then, that the judicious use of mineral oil in jute, cotton, and woollen factories, has rather a tendency to reduce liability to fires than otherwise.

These experiments were made on a considerable scale

and in a practical way by Mr. Galletly, of Addiewell Chemical Works, and were repeated twice before the results were committed to paper. The 'Oil Journal,' speaking of the result at the time, concluded a leading article as follows: "We have no hesitation in recommending it to the careful attention of our manufacturing friends. To the general public the matter is of great interest and importance, and shows the necessity of care in the disposal of oily rags or waste of any description."

A careful study of these deeply interesting and apparently trustworthy experiments is earnestly recommended to the thousands—perhaps it may be said millions—of persons who necessarily use large quantities of tallow, lard, grease, oil, and other fatty substances for manufacturing, lubricating, and even domestic purposes. It can hardly be doubted that heavy fires have frequently occurred through neglect or ignorance of the principles so clearly and forcibly explained in the paper here quoted.

It may be well here to make a few remarks concerning the precautions which should be taken for safety of life in schools, prisons, places of amusement, and other buildings in which large numbers of persons are necessarily congregated together.

In many countries, and especially in France, the national discipline is so complete, and the communication between the public departments so perfect, that the fire brigades can supply themselves with ladders which will fit into the windows of every building, and this arrangement is faultless so far as the requirements of the fire service are concerned. Indeed to the ordinary observer it does not appear to have faults of any kind, though doubtless to the independent Briton of the *civis Romanus* type it might seem a grievance, to be compelled to build the window sills of a house on such a pattern as to suit the appliances of a fire brigade or any other public body.

In all the great cities of England every possible precaution appears to be taken to prevent the entrance of

persons from outside by any way except that in common use. Windows are carefully barred and locked; unnecessary doors are fastened by prepared bars and cunning obstacles of many kinds; and, where the walls communicate with those of other buildings, as in streets or rooms, a *chevaux de frise* or other impassable barrier is placed between the roofs, and the dormer windows are armour-plated or otherwise rendered impracticable from the outside.

Thieves no doubt are aggressive, and servants must be restrained from unauthorised nocturnal wanderings; but it is by no means certain that the excellent and well-meaning persons who adopt these elaborate precautions are always fully aware that their barriers work both ways, and that under circumstances not difficult to conceive they may cause terrible loss of life.

This question arises periodically, and of late years a more liberal and practical consideration of it has led to a corresponding relaxation of certain rigid enactments in prisons, schools, lunatic asylums, and other premises in which large numbers of persons are crowded together under the control of a responsible authority; but many still remain which would certainly involve a fearful sacrifice of life in case of fire.

It is not well known whether in these cases the controlling authorities have made any actual calculation which they could quote as their justification in the event of a disaster; but, if they have, it would probably be somewhat of this kind.

The annual insurance of these premises is five shillings for each hundred pounds, which virtually means that if the building lasts 400 years, the Insurance Company is just repaid. Now the building contains (say) 100 persons, and there are 365 days in each year; and assuming that only one of the inmates wished each day to make an unauthorised exit, there would be during the estimated lifetime of the building 146,000 such occurrences. Shall we purchase safety from this large number of gross irregu-

larities by incurring the risk of a disaster calculated by professional authorities to occur only once in 400 years?

Some of those responsible answer this question to themselves in one way—some in another—but it is earnestly to be hoped that all have considered it carefully, and that, when a disaster does occur, they will be able to justify their conduct in the only way which will satisfy the world at large, namely, by demonstrating that every possible precaution was taken to prevent loss of life, and that they themselves were at all times, and especially at the moment of the disaster, in greater danger than any of those under their charge.

It is too much to be feared that the converse of this is often to be found, the responsible persons having provided for their own safety absolutely, and for that of those intrusted to their care either very imperfectly or not at all. A thoughtful consideration of this subject in its several bearings is recommended to the attention of all who have control over large numbers of persons, and must necessarily keep them under lock and key.

But there are other places besides prisons, schools, and lunatic asylums, in which precautions should be taken with regard to entrance and exit.

Events of recent years have drawn an unusual amount of attention to the condition of theatres and other buildings in which large numbers of persons are congregated together, and perhaps a few words on this subject may be of service to those interested.

Safety from fire in such places can only be attained by simplicity of construction, involving clear and definite plans for the separate exit of each part of the visitors, computed by levels or such other classification as special circumstances indicate, in every case preventing two streams of persons meeting at right angles, or in any other way likely to cause confusion.

So little common understanding is there between the several proprietors or managers of theatres, that it is no easy matter to make anv classification at all with a view to

reducing the subject to anything like system or method. Not long since it was found that in a single city every house of this kind was constructed on plans of its own wholly distinct from all other plans, and almost every part of every house was called by different names, according to the caprice of the owner or lessee.

Thus, although the number of levels occupied by an audience ranges between two and seven, a methodical inspection brought to light no less than thirty-four names of the several parts, as follows : amphitheatre, amphitheatre stalls, amphitheatre tier, balcony, balcony stalls, side balcony, boxes, side boxes, upper boxes, private boxes, circle, lower circle, family circle, dress circle, first circle, upper circle, upper box circle, gallery, lower gallery, upper gallery, gallery slips, gallery stalls, gallery stalls tier, pit, pit stalls, stalls, orchestra stalls, ground tier, upper tier, first tier, grand tier, pit tier, fauteuils, and promenade.

It was discovered what each of these names was intended for where it was used ; but, with very few exceptions, they were all used differently in different houses, and in some cases were used differently in the same house at different periods of the year.

No remedy could well be proposed for this, as a compulsory nomenclature might be an unnecessary and annoying interference with the private affairs of managers ; but it may be suggested that those commercially interested would lose nothing by agreeing among themselves to adopt a few simple names which would be understood and remembered by the general public, and by having these names legibly marked, not only on the places themselves to which they apply, but on all the passages and staircases leading to and from those places.

A careful study of the description of most exits will show that an appreciable portion of the confusion in getting out of the houses arises from the difficulty which the audiences experience in understanding the terms employed. Too much must not be made of this point, though it certainly goes to prove that, if those who have

to make professional surveys are perplexed by the names, the visitors must be much more so; but it may be suggested that, although in such cases too much method is certainly to be deprecated, on the other hand too much freedom has lead to caprice on the part of managers, and consequently to confusion on the part of audiences.

In dealing with the exits from theatres, it is necessary to call special attention to the perversity of ingenuity which sometimes characterises the arrangements of houses for getting the visitors away. Cases have been known where a whole building intervened between the auditorium and the street, and the space actually existing was more than ample for the escape of an audience, and yet every exertion seemed to have been used to make the passages, corridors, landings, and stairs as complex and tortuous as possible, and, having done this, then to obstruct them, and make them still more inconvenient by pay-boxes, cloak-rooms, barriers, refreshment counters, single or double steps, and partial walls, thus causing nightly confusion and annoyance to the visitors, and adding, moreover, very considerably to their risks in case of panic from fire or any other cause.

In many cases the first point of actual safety reached by the audience is the street door into the open air, although the removal of a few walls, barriers, pay-boxes, and other obstructions, now wrongly placed, would make it 50 or 60 feet nearer the seats, and thus add greatly to the comfort and safety of the visitors.

In some theatres the attendants seem to spend the greater portion of their time in showing visitors the way; and the visitors, even after being shown the way out by one or two attendants, have still to go on asking until they reach the vestibule or outer door. It may be distinctly said that all this is wrong and dangerous, and it is quite certain that the safety and convenience of the audience, and indirectly of the owners and managers, would be increased by stringent rules on this subject.

A licensing authority should not permit the existence of

any exit requiring a guide, and it may be doubted whether any should be permitted which could not be adequately described in half a dozen words. In dealing with exits it might also with advantage be laid down that there should be some limit to their length, that is to say, to the distance from the spot in which the most remote visitor is seated to the point of absolute safety. This ought not to exceed 200 or 250 feet, as every audience contains a proportion of stout, and old, and weak persons, who could not go quickly further than this distance without becoming exhausted, and who in any case indirectly influence the speed of the whole audience in getting away.

Again, a limit should be assigned to the number of persons to be brought together at one spot, no matter what the area may be, and this might be about 400. Any greater number should be separated by strong barriers to prevent crushing.

For the safety of an audience it would be most important that the construction of simple separate exits should be encouraged ; and in the galleries and other very high parts the stairs should be duplicated, so that, in the event of a rush of smoke to one, the other could be made available. It would be best that all exits should lead into the open air ; but the point is not so much where they should lead as that they should lead by a short route to a place of safety.

The practice of closing any portion of the regular exits of a theatre for distinguished visitors is most dangerous, and should on no account be permitted.

If a separate exit is necessary for such persons it should be made specially, and should extend to the outer air, so as not to interfere with any of the ordinary exits for the rest of the audience.

Before the licensing of a theatre for the reception of an audience, some such regulations as the following should be complied with : — The responsible owner of the house should deposit complete plans and drawings, and should make a formal application, stating distinctly what he asks

for. The plans and drawings should be accompanied by a full description of the construction and general arrangement of the premises; the area of each level or other part occupied by a separate portion of the audience; the number of persons which the applicant asks leave to place in each part; and the means by which these persons have to reach the outer air, carefully mentioning every step, change of level, incline, and turn, and of course giving dimensions and measurements of every kind.

Every theatre contains a stage and auditorium, but every theatre does not contain a carpenters' shop, a store for the deposit of properties and lumber, or a scene-painting establishment; and it should therefore be laid down as a rule from which there should be no departure, that the carrying on of manufacturing or storing within the walls of a theatre is not a necessity. As, however, the transactions of these operations on a small scale and for temporary purposes is a great convenience in all ordinary theatres, and something more than a mere convenience in the great opera houses, it need not be altogether prohibited; but it should be clearly known by all concerned that the operations are both unnecessary and dangerous, and should not be carried on within the risk of an audience, except under very special circumstances.

Above all, it should be distinctly understood that a license for a theatre should only cover the stage, auditorium, and outlets, and that for anything in addition to these a special license would be required. Thus, a building might be licensed as theatre, carpenters' shop, scene-painters' shop, scenery stores, property stores, refreshment rooms, smoking rooms, or anything else which might be required; only each of these points should be dealt with quite separately, and special licenses should on no account be issued without an absolute certainty that no danger could arise to an audience from the operation, whatever it might be.

Under a proper inspection, the restrictions to be applied in such matters, although very rigid, would be very few,

and would place no difficulty whatever in the way of any one commercially engaged in the success of theatres, and these are virtually the only persons who have to be consulted in the matter. As a rule, to which there will probably be very few exceptions, perhaps none at all, all lessees, actors, and persons engaged in every way in the actual management of theatres, will be assisted in their work by these proposals, and this is a most important point in connection with the general subject.

It is quite understood that the sunlight or other great burner over the auditorium must always be under the control of the gasman on duty on the stage; but there is no reason why it should be supplied from the same source as the lights on the stage. On the contrary, it might with perfect safety and convenience be supplied from the same source as the other lights of the auditorium.

It should be impressed on all persons employed in and about a theatre, that, in the event of a panic from smoke, fire, or any other cause, the essential conditions of safety for an audience are light and air, and that, of these, light comes first in importance. However dense the smoke may be, it is quite possible for persons to make their way a short distance to the fresh air, provided that they have light; but without light the calmest individuals, with plenty of room, become confused, and a dense crowd is instantly affected with panic, even though there may be no smoke or flame.

It is hardly too much to say that, however fiercely a fire on the stage of a theatre might burn, if it were possible instantly to remove the whole roof and to turn on a very strong light, not a single life would be lost. This is a point which appears not to be sufficiently understood by those engaged in and about theatres, and it should be laid down as a rule that, in the event of a panic, the first steps to be taken by those responsible for the safety of the audience, should be to turn on all possible lights, to drop the heat-proof curtain, and to open a smoke outlet over the stage. With such an arrangement there would be very

little probability of a panic continuing, and almost a certainty that, even under the most adverse circumstances, the loss of life would not be serious.

The knowledge of a danger adds greatly to the excitement of a crowd, and it is a very strange fact that dangers not at all obvious to a casual observer do in some way become known to audiences, and are always exaggerated by them. The probability is that they become known through the actors and others engaged in the house; and, if this surmise is correct, the matter may be considered from a practical point of view, and owners and others commercially interested may be brought to recognise as a fact that any danger existing is certain to become known, to be exaggerated, and to do them an injury, and that, even commercially considered, it would be to their interest to remove it, and to make known that it has been removed.

In order to prevent dangerous consequences in the event of a panic, a theatre should not only be made safe, but it should be made in such a way that the audience would know that it is safe. Indeed, this knowledge on their part would go far towards preventing a panic, and there is every reason to believe that this desirable result can be accomplished without interfering with any of the legitimate objects for which theatres are made; but of course it can only be done by a bold departure from some of the modes of construction hitherto permitted.

A strict system of inspection should be established, and the duty might be entrusted to the police, or others who have large experience in dealing with crowds. These skilled inspectors would be able to afford to managers all the advice which might be needed; and, if they exercise judgment and discretion, they ought to cause no hindrance to any legitimate operation. But, at the same time, they should certainly be armed with all the necessary authority for carrying out their duties, even to the peremptory and instant closing of the houses in case of any real emergency involving danger to an audience.

In London alone there are forty-one theatres, varying in

the numbers they can hold, from under 500 to nearly 3000, and capable of accommodating on the whole over 55,000 persons.

An effort has been made to ascertain the actual number of persons who go to these theatres, but without success, because the managers generally count by the money received, not by the persons who enter, and, as they give away a large number of tickets, this calculation must always be erroneous.

Probably, in most theatres, there is a very moderate attendance on the middle days of each week; but on Saturdays and Mondays there are generally good houses, containing some two-thirds of the total number which they can hold, and at certain periods of the year, as for instance, Christmas, Easter, and Whitsuntide, nearly all the houses are crammed to the roof.

It is at these periods, and also on all exceptional occasions, such as the run of a popular play, that the limitation of numbers becomes absolutely necessary for the safety of the audience.

In some theatres it was formerly the custom, under certain circumstances, to put up a notice near the pay-boxes, "Standing room only." And again in others there used to be a recognised system of what were called "overflow tickets." The mere mention of these two expressions points to a danger of a most frightful kind.

Allowing that on ordinary evenings the total attendance in London is about 25,000, and on Saturdays and Mondays about 40,000, it is not unreasonable to suppose that at certain periods, or on exceptional occasions, it runs up to some 70,000, which is far beyond what the houses can safely hold, and the same rule probably applies to theatres elsewhere.

This is perhaps mere surmise, or at best a calculation based on very doubtful figures, and, as far as can be ascertained, no two managers agree on the point; but it is certain that in all cities theatres are at times dangerously crowded, and that consequently a regulation limiting the numbers in

each part of each house is imperatively necessary for the safety of audiences.

During the last year or two great improvements in this way have been made all over the world, especially in America and some of the great cities of Europe; but much still remains to be done, and it is earnestly to be hoped that the good work may be continued until such catastrophes as those of Brooklyn and Vienna will have become impossible. It cannot be too often or too strongly asserted that there is no difficulty whatever, and, if done during the construction, no expense, in insuring the reasonable safety of theatres and other buildings in which large numbers of persons are collected together.

The duty which is very properly cast upon fire brigades, of being responsible that efficient measures are taken to endeavour to rescue endangered persons from burning buildings, is one which causes great labour to firemen.

The densely populated condition of their cities; the risks arising from the imperfect construction of many of the houses; the carelessness of the people in dealing with spirit-lamps, lucifers, and fires, especially among the lower classes; the risks from intoxication; from carrying on dangerous businesses on the lower levels of houses the upper floors of which are devoted to dwellings; and the innumerable other causes of fires, for which space cannot be found here to attempt even an enumeration; all reveal to firemen much cause for watchfulness and energy.

It is well understood by most people, and certainly by all firemen of experience, that despite the best life-saving and fire-extinguishing arrangements that may be made, and with firemen however fearless and well trained, unfortunate cases of loss of life at fires will occasionally happen.

The circumstances attending fatal fires are always made the subject of a searching investigation by a coroner and a jury of persons residing in the neighbourhood, and at these inquiries the firemen are called upon to show that everything was done on their part to avert the calamity.

It is found at times that delay in apprising the Fire Brigade has destroyed what small chances there were of rescuing the inmates, and in other cases unfortunate combinations of adverse circumstances occur; and it is almost invariably proved that no exertions on the part of the Fire Brigade after their arrival could have altered the result.

The number of fires in London in which life was seriously endangered during the year 1883 was 112, and the number of these in which life was lost was 29.

The number of persons seriously endangered by fire was 176, of whom 137 were saved and 39 lost their lives; of the 39 lost 13 were taken out alive, but died afterwards in hospitals or elsewhere, and 26 were suffocated or burned to death. This loss of life can hardly be considered heavy, being only one person in 98,000.

One of the great difficulties with which fire brigades have to contend is the enormous height to which buildings are erected without any precaution whatever to the safety of life from fire in the upper stories.

A fire escape, such as those in general use, can immediately on arrival reach a height of 30 feet; can, after about half a minute's delay, be made to reach 40 feet, or, after about a minute's delay, 50 feet; but it can only in a few exceptional cases reach higher, and consequently persons living in lofty buildings should make their own arrangements for getting down externally to spots within reach of these machines, which are at present the only means of escape available from the outside.

For this purpose there are many obvious plans which might be adopted, and among these are two which are specially easy of attainment, and within the reach of all concerned at a moderate cost. The first is to fix on buildings external ladders of wrought iron, or some other material likely to be able to resist the effects of fire at its commencement, and extending from the roof to within 40 feet of the ground; the other to provide on every story continuous balconies of wrought iron or any other material proof against immediate destruction by heat; and if these

balconies on the several stories were made to communicate by external stairs, great additional safety would be attained. With such an arrangement, heavy loss of life would be most improbable, however rapid the action of the fire might be.

In rows of houses the use of balconies is manifest; but even in detached buildings there can be very little doubt that if sufficiently long they would serve as a means both of egress for those inside and of access for those giving help from without.

Of course it may be said that these are likely to be used for improper purposes; but those who take this view must be prepared to accept the results of a fire causing loss of life as the direct consequence of their own state of preparation against another danger of a different kind.

The difficulty in procuring higher ladders than those now generally in use is the limit of weight, which, for the sake of rapid travelling with the machines, it is found necessary to restrict them to.

It would be well if endangered persons could bear in mind the necessity for presence of mind and intelligent action during the first moments of an alarm, before it is possible for assistance to arrive. Indeed, without the exercise of some intelligent activity in this way, the chances of saving life when fires occur would be greatly reduced, as some time must always elapse before the arrival of aid from without, and in even the best managed cities there may be some parts for which ten minutes would not be too much to allow.

It cannot be too frequently or too strongly impressed on all persons living in crowded cities that their dangers from fire are twofold,—namely, internal, or those arising from what may happen in their own houses; and external, or those arising from what may happen in adjoining premises; and that, however cautious they may themselves be, they have no power of preventing external risks, and should therefore be prepared to take measures for their own safety, immediately on the outbreak of fire. They should know thoroughly the construction of their houses, and

especially the several means of egress, such as doors, windows, dormer windows, balconies, skylights, hatch-traps on the roof, &c. They should also study those parts of their houses accessible to fire-escapes or other ladders, so that in case of failing to get out, they would be in readiness to be taken out by the firemen at once on their arrival; and for this purpose front windows looking on the street are generally available.

The most important point of all, however, is the closing of all doors and windows except those which it may be absolutely necessary to keep open for admitting air to the inmates; indeed on this part of the subject it is not too much to say that if every door, window, and other aperture were invariably left open, all houses once well on fire must be almost inevitably burnt down.

In short, all persons endangered should rely on their own resources during the first moments of an alarm, and after a period which they can calculate for themselves according to the locality in which they live, they may expect an attendance of firemen with proper appliances, and the skill and energy to use them to the best advantage, regardless of all personal risks so long as there is a hope of saving life or property.

In one word, the public may rely on a fire brigade to a very great extent, but must not do so altogether, as in many cases the success or failure of firemen depends absolutely on what the occupiers do, or omit to do, before their arrival.

The tendency of commerce has always been to concentrate particular stocks in certain portions of great cities, and latterly to bring together enormous deposits of goods into buildings of corresponding magnitude, frequently in dangerous proximity to each other; and the result is that in all large commercial cities there are localities the protection of which calls for the skill and energies of the most active and well-trained firemen, and the smallest accident or delay may lead to overwhelming disaster.

This concentration of vast stores of merchandise in build-

ings of inordinate area and height has changed the whole course of proceedings in connection with large fires, making it necessary to provide appliances capable of being quickly moved about.

In England, and indeed in several countries of Europe, this has been done for many years; but curiously enough in America the tendency has been in the opposite direction. The Americans long ago took the lead in steam fire-engines; but they stopped where they began, and at this moment nearly all their splendid machines are far too heavy and unwieldy for the work, and the same may be said of almost everything they have in use.

So heavy have their hose and other appliances become, that they cannot be carried on the engines, and consequently every station has extra horses and coachmen, at, of course, a considerable extra cost; but this is not the only draw-back. The use of heavy appliances necessarily makes quick movements, even on the ground, most difficult, and, on ladders, walls, or other heights, simply impossible. Moreover, in America the men are wrapped up in heavy oilskins and sou-westers, which retard their action, and prevent them from getting close to their work.

All over the continent of Europe, on the contrary, every effort has been made to lighten the appliances until, in the eyes of Americans, and sometimes even of Englishmen, they appear almost ridiculously small.

Here in England, and notably in the Capital, no effort has been spared to get all the appliances of the strongest and best kind for the hard rough work, and, at the same time, of the greatest lightness consistent with the necessary strength; and the result is a sort of medium between the cumbrous and unwieldy materials used in America, and the almost toy-like small gear on the continent of Europe.

It is strange how most countries follow the example of their own Capital in these matters.

Paris has established a very small type of hand-engine, which can be worked by eight men, with very light hose and other gear; and all France, from Marseilles and

Bordeaux to Calais and Dieppe, has done the same, though the conditions of the several places are manifestly different. For instance, the requirements of Lyons and Trouville must be very different, and yet they have the same equipage for extinguishing their fires.

Brussels has a corps all living in a central barrack, but distributed for duties throughout a number of little posts in various parts of the city; and Antwerp has a precisely similar arrangement, though the former is purely a residential city, and the latter a place of manufacture and a commercial emporium of great magnitude and importance.

Berlin has a large central place as head-quarters, several first-class stations, each with three so-called trains and twenty horses, and second-class stations, each with two trains and fourteen horses; and Hamburg has a precisely similar arrangement, while one is a city of palaces and private dwellings and the other is the largest commercial port of Germany, perhaps of all Europe.

Vienna has an over-centralised system, with head-quarters, depôts and sub-depôts; and Trieste and Venice have the same, though they are essentially different in all their requirements.

New York has massive engines, massive hose, massive appliances of every kind; and this example is followed by every city of the States, and unfortunately to a great extent by those of Canada, although it must be evident to even the most casual observer that the requirements of the great centres of manufacture, import and export, must be widely different from those of the residential places and pleasure resorts.

The cause of this state of things is not far to seek. On the continent of Europe everything is done on a military or quasi-military system, and the limit of knowledge is that which prevails at the capital. In America the whole business of the fire departments is carried on by Commissions, and the firemen say that the Commissioners are political men, and during their period of office act as political agents.

If this view, which is universally expressed by all the serving firemen, be correct, it is obvious that the fire departments in the West have at least one great point of difference from those in Europe.

The system of Boards of Commissioners appears to be an institution in the United States, and, as it suits the people, it will probably continue; but it is fraught with many dangers, and these should be carefully studied by all who have the real interests at heart. Take, for instance, the case of a fire department—one only out of many. If the executive officials originate everything, and the Commissioners only confirm or reject the proposals made to them, there is no reason why the system should not work well. But on the other hand, if, as is so strongly and constantly affirmed, the Commissioners are political persons unconnected with the business, and yet interfere with the executive in the discharge of their active duties, great danger and disaster might result.

America has long had the most perfect building laws, carried out by Commissioners; it has had water brought into all the great cities and distributed throughout the streets by Commissioners; it has had its fire departments organised and worked by Commissioners; all which, theoretically considered, appears to be a perfect arrangement, and yet the fires there have been of singular magnitude, and the insurance-rates are higher than those of any other country.

But if a professional fireman could ever allow his imagination to range a little, and pass from actualities to possibilities, his first thought would probably be as to what would occur if all the existing fire brigades of the world were to be suddenly destroyed by a physical convulsion or political revolution.

In almost all the cities of the Old World, the knowledge of these matters is distinct and business-like — it may be called unprogressive—but on the whole rather safe, and the new appliances would probably be somewhat like the old; but in the cities of the West nothing of the

kind would happen. Each state, each district, each city, each village would set forth on new lines, and would produce astonishing appliances. There is knowledge in America, and those who seek for it can find it. It is only the superficial observer who supposes that, because all their appliances are of the same type, there is no imagination, no invention in the country. Those who go a little deeper know that the opposite of this is certainly the fact.

Politics may or may not have anything to do with fire departments; but however this may be, there is knowledge there which, in spite of politics or other evil influences, will often enable those responsible to tide over serious difficulties; and this it is which leads the thoughts of an observant visitor in the direction already indicated.

Hose is required in large quantities, and is difficult to produce, as it has to be made by special machinery, and this probably would continue to be purchased as at present from general manufacturers; but there is scarcely another article used by fire brigades which could not be produced by any skilled mechanic such as can be found in every city of America, and perhaps at less cost than at present; but then it is certain that many of the heaviest and most expensive appliances would never be heard of again, as they are very seldom used now, and are purchased only for the benefit of the makers.

In short, the result might be expected to be somewhat as follows. Everything considered necessary by the firemen would be made up under their own instruction by the mechanics of the place, and would be of the simplest and least complicated description. The carpenter, the engineer, the blacksmith would each receive his instructions from the man who has to use the appliances, and who of course knows precisely what he wants, and also what he does not want, which latter point is very important. Hardly a single patented article would be found necessary, as the same or better results can be obtained from the appliances in ordinary use for other purposes.

Let the example of a vessel's fittings be considered.

The hull and spars being provided, a crew is turned on board with a few tons of rope, some bolts of canvas, and a cartload of blocks and other small gear, and in a month or two the vessel goes to sea full rigged and with every sail bent.

Doubtless improvements have been made of late years, some of them valuable in their way for saving time and labour, and, in a few cases, enabling sailors to do things which were formerly very difficult, if not almost impossible; but, while these changes are not in any way ignored or under-estimated, it may be broadly asserted that the greater part of a sailor's work, in fact all his best work, is done with his own hands, and he uses the rudest kind of appliances, prepared impromptu by himself according to his necessities at the moment, and taken to pieces and stowed away in the lockers or along the deck when done with. A sailor's speciality is what is termed "man-handling," and in proportion as he is skilful or otherwise at this he is efficient or inefficient in his calling. This parallel must be obvious to all who know what the serious business of a fireman really is.

A fireman, to be successful, must enter buildings; he must get in below, above, on every side, from opposite houses, over back walls, over side walls, through panels of doors, through windows, through loop-holes, through skylights, through holes cut by himself in the gates, the walls, the roof; he must know how to reach the attic from the basement by ladders placed on half-burned stairs, and the basement from the attic by a rope made fast on a chimney. His whole success depends on his getting in and remaining there, and he must always carry his appliances with him, as without them he is of no use.

Judged by this standard, the business will be seen to be dependent almost entirely on the man and not the gear, and all the best experience has abundantly proved that, however good the machinery and appliances may be, they cannot work themselves, and without active, energetic, intelligent, and fearless men, are virtually useless.

It is true they may enable the men working from a distance to save adjoining premises, but this, although sometimes the only thing to be done, is a poor function for any one who claims to be a fireman. But enough of this train of thought, which has only been followed so far for the purpose of pointing out how strange it seems that, in the great land of plenty and prosperity, the land of restless energy and boundless ingenuity, it should be considered wise to spend only for the sake of spending, and to exert ingenuity merely for the purpose of producing something that is ingenious.

The Americans claim to be the inventors of the steam fire-engine; but their claim is disputed by Englishmen, and a close investigation results in giving the credit of the first of these machines to England, though here the credit ends; as, whether from apathy or ignorance, the public authorities did not adopt it. This steam fire-engine was undoubtedly heavy, and, judged by comparison with those of the present day, may have been somewhat complicated; but there can be very little doubt that it was a sound and trustworthy machine, as there is reason to believe that it worked down in a coal mine in Germany every day for nearly twenty years, and for anything that is known may be working still.

The maker always complained of the want of encouragement shown to him by the authorities; but it may be hoped that he had a consolation and a good reward in the humbler but not less useful sphere to which his valuable machine was relegated.

The Americans next took up the subject of steam fire-engines warmly, and produced some wondrous pieces of mechanism; but, strange to say, they neglected two essential points—fitness for the special work, and lightness.

Many of the American steam fire-engines are perfect models in every other point but these. In design, material, and workmanship, they compare favourably with any machinery ever made, but they convey the idea of having been constructed by marine or locomotive engineers, without the assistance or advice of firemen.

It may be that the present condition of things in this way is the result of the cities having confided to their Fire Commissioners the power of ordering appliances without a requisition from the Chief of the Department, and accepting them without his certificate—at least such a result would certainly follow from such a course of action—but it is by no means certain that the power in question has been delegated by the cities, or that, if delegated, it has ever been used by the Commissioners.

It is more than probable that the numerous complaints to that effect which incessantly weary an enquirer are either baseless or very much exaggerated, and if so the reason for the heavy and expensive appliances must be sought in other directions.

Some of the English steam fire-engines of the present day are admirably adapted for the special work they have to do, and may justly claim to be examples of the perfection of strong light mechanism.

In America all the fire departments were formerly voluntary, and the engines were worked by the so-called firemen. This necessitated a large number of enrolled members, many of whom were not in any sense firemen, and the control over them was naturally very imperfect. It then became expedient to establish organizations; but there still remained the difficulty of dealing with the enormous number necessary for working the pumps, as it seems never to have occurred to the authorities to adopt the European practice of employing the crowd for this purpose.

It was then suggested that the pumps might be worked by steam, and, after this method was tried with success, the old voluntary arrangement was by degrees abolished in nearly all the large cities, and replaced by paid departments with steam-worked instead of hand-worked pumps.

This apparently gave rise to the present custom of treating as a sort of synonymous terms volunteers and manual fire-engines—paid departments and steam fire-engines—a custom which seems most curious to strangers,

as it is openly acknowledged in America that the firemen generally, and even the superior officers, have no knowledge of steam; and the steam fire-engines are worked, not by firemen, but by engineers specially employed for the purpose.

As a matter of fact, volunteer departments might with equal propriety be considered synonymous with steam fire-engines, and paid departments with manuals; but the habit of combining or confusing terms in this way is an accident of language not uncommon in America, and impresses a stranger forcibly because it is almost universally adopted, even by educated persons.

In every case the appliances of firemen should be few; they should be strong, light, simple, and capable of all the innumerable adaptations necessary for success in a business involving constant rapid movement and very rough usage.

Out of the millions of clever inventions recorded in all the patent offices of the world, there are not many that could pass this simple test, and out of those which would pass there are few absolutely indispensable to a fireman. The remainder are for the most part useless, and for every reason ought to be dispensed with.

Inventors are doubtless very important persons, and have contributed largely to the advancement and prosperity of the world; but in connection with fire brigades they have added fearfully to the expenses, and it is by no means certain that a better result could not have been attained by a smaller amount expended in other and simpler ways.

In a paper of this kind it would hardly be right to omit a passing reference to one of the pestilences of our time, the shopmen who assume a fireman's name, clothe themselves in a fireman's garb, and go about under the pretence of giving advice, but in reality for the sole purpose of selling their employer's wares, frequently those which have been previously rejected by some of the fire brigades.

The amount of injury done by these men is incalculable. They are necessarily ignorant of the subject, and their

advice must always be interested. They know nothing of the progress which is being made, and, if they were informed of it, they would not understand. All they know is that the sale of certain goods pays, and that of others does not; but their enterprise and persistence are such that they occasionally succeed in foisting on an inexperienced merchant, manufacturer, or private gentleman, some article so long obsolete that real firemen of ten or fifteen years' service may have never even heard of it.

The desire of many large firms to partially protect themselves, by providing fire-extinguishing appliances has been very marked within the last few years, and has been encouraged in every way by all firemen who study the interests of those on whose behalf they serve; but it has been constantly thwarted and frequently paralysed by these wandering shopmen, who merely give unpractical advice, and send in exorbitant charges. There is hardly a leading fireman of any reputation who does not spend an appreciable portion of his time in protecting commercial firms and others from this form of extortion; but it is only just to say that some of the respectable makers of fire-extinguishing appliances have never stooped to this mode of transacting business.

The necessity for some measures being taken to guard against the destruction of property by fire must have been felt from the very earliest years of civilization in this country; but such attention as our ancestors seem to have devoted to the subject was rather towards preventing fires, and it is only of comparatively late years that any efforts have been made in the direction of extinguishing them.

London may be taken as an instance of this neglect. Considering its enormous population and boundless wealth, it can scarcely be believed that until the year 1866, or exactly 200 years after the Great Fire of London, no public fire brigade had been organized, and this great and pressing want had only been supplied by private and commercial enterprise.

At a very early period there were certain primitive rules

for the protection of property from fire, and for preventing the fires from spreading, but no really important measures were adopted till after the fire of 1666.

The great danger to which the city was then exposed seems to have opened the eyes of the people, and orders were issued that ladders and buckets should be kept for extinguishing purposes in different parts of London.

The catastrophe of the Great London Fire of 1666 seems to have awakened the authorities to the fact that the system of buckets, although it possessed that great essential of fire appliances, simplicity, was not quite so effective in its working as was desirable, and accordingly the inventive genius of the age was set to work to devise some method of directing a more continuous and at the same time concentrated stream of water against the flames.

In a very short time the first step towards the modern fire engine had been made, in the form of a large syringe, of which pattern an Act of Parliament of Charles II.'s reign, ordained that at least one should be kept at hand in every ward of the city, and worked in case of need by the respective aldermen.

The appearance of this syringe is shown in the accompanying illustration. It consisted of a large cylinder, about three feet in length, with a long nozzle projecting from one end, the whole body of the instrument resembling in some degree a magnified wine bottle, with the difference that at about a quarter of the distance from what would be the base to the shoulder of the bottle, two semicircular handles were attached, one at each side. Inside this cylinder a piston was worked up and down by means of a piston-rod passing out through the opposite extremity, and the outer end of this rod was enlarged by a round metal knob or plate. It was, perhaps, in this enlargement that the chief claim to originality on the part of the invention lay.

Syringes had been known before, though these were certainly constructed on a larger scale than was usual; but there were peculiar necessities attached to the working of these in question, and the inventor is entitled to credit for his in-

A.D. 1667.

A.D. 1707.

[redacted]

[redacted]

[redacted]

genuity in adapting them to these necessities. The syringe was filled in the ordinary manner, and then the manipulator had to take hold of the handles, one in each hand, and, pressing the enlarged head of the piston-rod firmly against his stomach, draw the handles steadily towards him, at the same time turning the nozzle towards the flames.

Former experience had shown, if not actually in the case of working syringes, at any rate in other phases of human existence, that a sharp pressure against one particular point of the body is apt to be painful, whereas if the surface over which the pressure extends is enlarged, it is very often not even uncomfortable. Having consideration for this, the knob at the head of the piston rod was added, so that the aldermanic tambour might in no way be inconvenienced in the exercise of its owner's statutory duties.

In all probability, however, though we are not told for certain, the civic dignitaries might depute these duties to some person of inferior grade, only being held responsible for their fulfilment, in the same way that the sheriffs have from time immemorial been permitted to carry out the more unpleasant requirements of their office by proxy. But if, as may have been, it occasionally happened that such substitute was not easily obtainable, as in the case of an early call before the inevitable crowd had had time to assemble, the sight of a heroic body of aldermen encircling the fire, each one armed with his syringe, and each in turn discharging his stream in the prescribed manner against the flames, must have been one calculated to excite the admiration and respect of all who might have the good fortune to arrive on the scene in time to behold it.

This is a simple historical record handed down in due course, and if it seems in any way humorous it must itself bear the consequences. No disrespect or ridicule is intended by the recital ; on the contrary, every credit is given to the worthy civic dignitaries who had the courage to attack a formidable enemy with weapons which now appear inadequate : and, after all, it is quite probable that coaches and many other appliances of those early days would raise

a smile if contrasted with the luxurious and elaborate mechanisms of the present time.

Everything must have a beginning, and the aldermen of those days deserve high praise not only for bringing out the syringe, which was an improvement on what had existed before, but also for their independence in working it themselves, whereas their descendants employ hirelings for this same purpose.

After the syringe came many machines of various kinds, culminating at the beginning of last century in a so-called water-engine, worked by about a dozen men, and this in one form or other held its ground for over half a century, and is the prototype, and no bad one, of the manual fire-engine still in use. After the manual came the steam fire-engine of the present day with a power of 24 horses or 120 men, which is made so light that, when loaded with gear and men, it can be moved at a gallop by a pair of horses.

A glance at the illustration at page 60 will give a general idea of the three implements.

In 1707 another Act was passed, in which it was ordered that each parish should keep a fire-engine, and the Act also provided payments for the first three engines which should arrive at the spot.

This became an encouragement to the men, and great pride was felt by those in charge of the first engine arriving.

The payments were 30*s.* for the first engine, 20*s.* for the second, and 10*s.* for the third, and a reward not exceeding 10*s.* was also paid to the first turncock.

These rewards were at that time necessary, as there was no discipline, and the engine-keepers could not be got to attend by any other means; but rewards in an organised and disciplined force are not only unnecessary but demoralising.

It is remarkable that the Act only stipulated that the engine must be in good order, and be provided with certain appliances, but nothing whatever was said as to its effectiveness or the ability of those in charge. It is even on record that in some cases women were in charge of the

parish engines, though the proof of this perhaps rests on no stronger foundation than the pleasant fancy of a popular novelist. No matter how useless the engine might prove to be, as long as it was one of the first three on the spot it was entitled to a reward. A fourth engine might render far more effective assistance, and even succeed in extinguishing the fire, and yet never receive the smallest recompense. Before the above date a few fire insurance companies kept engines for the protection of property insured in their respective offices, the Hand in Hand, the first fire insurance company ever established in London, having the greatest number of these engines. The rewards were given to the keepers of the engines belonging to these companies.

These engines were placed in charge of active watermen, specially retained by the fire offices for the purpose. Those belonging to the parish were under the care of the beadles, generally old men, whose engines very seldom arrived early enough to enable them to claim the reward, and they thus gradually fell into disuse.

As the number of fire insurance companies increased, the number of engines became so great that the want of control and union was much felt. Jealousies and quarrels were constantly taking place between the watermen themselves and between these and the beadles; and sometimes while the disputes were being settled a fire was allowed to burn, without any attempt being made to extinguish it.

The companies soon found that the efforts of these men greatly reduced their losses, and it was thought advisable, both for the sake of economy and efficiency, to place all the engines under one head.

Negotiations were entered into by several of the offices, but there were many difficulties in the way. As the engines were constantly seen running through the streets, they became useful advertisements, and it was felt that if a union were effected, this advantage would be lost to those who joined it, while those who did not join would still enjoy this privilege.

No satisfactory arrangements were concluded until the

year 1832, and in 1833 the London Fire Engine Establishment was formed. It was managed by a Committee, composed of one representative of each insurance company concerned, and its immediate supervision and control was placed in the hands of a superintendent.

The late Mr. James Braidwood, who was at that time Firemaster in Edinburgh, was chosen to organise and command the new force. He had great difficulties to contend with. The petty jealousies of the firemen belonging to the different engines, the great dislike which they expressed of working together, and their many rivalries, would have compelled any man of less determination to give it up in despair, but Mr. Braidwood was not one to do this. He possessed experience and sound practical knowledge of the principles of fire extinction, with a stern devotion to duty. He overcame all the obstacles placed in his way, and soon turned the force into a necessary and recognised institution.

Mr. Braidwood remained in command of the Fire Engine Establishment until he was killed while superintending his men at the great fire at Cotton's Wharf, Tooley Street, in June, 1861.

The Establishment on the first of January, 1833, consisted of 76 officers and men, and was supported by 10 fire insurance companies, which were soon joined by two more, making 12 in all. The names were as follows:—The Sun; The Protector; The Imperial; The Westminster; The Atlas; The Alliance; The London; The Royal Exchange; The Union; The Globe; The Phœnix; and The Guardian.

The other companies, seeing the advantages arising from co-operation, were gradually gained over, and the number steadily increased, until in 1864 it amounted to 30, but this number was afterwards reduced to 28.

The expense of maintenance was derived from a rate levied on the contributing companies in proportion to their several annual insurances.

The rapid growth of the metropolis, and the consequent alarming increase in the number of fires, soon showed that

the brigade, although it was working with great efficiency, would require many additions, the expense of which would necessarily fall on the insurance companies to a much greater extent than was convenient to them, and in 1864 a formal notice was sent to the Home Office, stating that the insurance companies had decided to discontinue the London Fire Engine Establishment.

Some thirty years before this, about December, 1834, the companies wrote to the Duke of Wellington, showing that the Brigade was maintained in the special interest of the insurance offices, and that if two fires should, at the same time, require the services of the men, preference would be given to the property insured, to the possible destruction of Government or other public buildings. It was suggested that the parochial engines should be inspected by the Commissioner of Police, and be repaired and rendered efficient, also that they should be placed under one head when doing duty at a fire. The destructive fire which took place in the Houses of Parliament in 1834 gave rise to these suggestions.

The Duke replied that, while not denying that the arrangements proposed by the fire insurance companies might in some cases have beneficial results, it appeared to him that Government interference would probably cause private and parochial exertions to be relaxed.

It is impossible not to feel surprise at the words of the Premier on a subject of so much importance in connection with the safety of life and property. These views, however, were not peculiar to the Duke, but were shared by his successors up to a comparatively recent date.

After this correspondence small additions were from time to time made to the establishment.

Up to 1852 the appliances on the River Thames for extinguishing fires in the large warehouses on its banks consisted of two barges, each having on board a large fire-engine worked by hand; one pumped by forty men and the other by sixty. In this year steam power was used to work one of the engines, and this was the first introduction

of it into the London Brigade. In 1855 a powerful steam floating engine was constructed, and the manual floating engines were abandoned.

In 1860 a land steam fire-engine was constructed; it was at first hired monthly, but was eventually added to the strength of the Brigade.

All this time the number of fires continued to increase with alarming rapidity, and the work became more and more heavy.

So matters went on until the destructive fire at Cotton's Wharf, Tooley Street, in June, 1861. The history of this fire is so generally known that it is only necessary to say that by it several lives were lost, including that of Mr. James Braidwood, already mentioned, and that property to the value of one million three hundred thousand pounds was totally destroyed.

This fire not only proved a great pecuniary loss to the insurance companies, but it showed them the utter inadequacy of the Force to cope with fires of such magnitude.

The insurance offices had calculated, in their own interests, that the most valuable insured property existed within a radius of three miles from the Royal Exchange, and that consequently it was within this area that they had the most to fear from loss by fire. They therefore situated their engines in such a way that they could all arrive in a short time at any point within this space. This arrangement was soon found to be somewhat unsatisfactory, as great and important warehouses were constantly being built in all parts of London, and generally it was seen that the Brigade, which before had been thought sufficient was, under the altered circumstances, fast becoming powerless.

The associated fire offices considered that the time had arrived when some new arrangements should be made, and they determined to apply to the Government again. They told the Home Secretary that they could no longer be responsible for the safety of London from fire, as they considered that it was no more a part of their duty to protect the lives and property of the people from destruc-

tion by fire than to guard them against thieves and murderers, and they expressed their intention of discontinuing the maintenance of the Brigade at an early date.

They also intimated that they were willing to transfer gratuitously the existing stations, engines and appliances, to such authority as the Government might appoint.

In February, 1862, a letter to this effect was addressed to Sir George Grey, at that time Home Secretary, in which reference was made to the municipal systems of several large provincial towns.

In the same month of that year a Select Committee of the House of Commons was appointed to inquire into "the existing state of legislation, and of any existing arrangements, for the protection of life and property against fires in the Metropolis."

This Committee, after taking advice from all who were in a position to offer any, and from many who were not, made the following recommendations :—

"1. That a fire brigade be formed, under the superintendence of the Commissioners of Police, on a scheme to be approved by the Secretary of State for the Home Department, to form part of the general establishment of the Metropolitan Police, and that the Acts requiring parishes to maintain engines be repealed.

"2. That an account of the expenditure of the new police fire brigade be annually laid before Parliament, together with the general police accounts, in such a manner that the special cost of the brigade may be ascertained.

"3. That the area of the new fire brigade arrangements be confined within the limits of the jurisdiction of the Metropolitan Board of Works, with the option to other parishes to be included, if within the area of the Metropolitan Police."

The Committee added the following sentences, which may still be studied with advantage by all who are interested in the subject :—

"In conclusion, your Committee would beg to state that

in their opinion no security can be given by legislation on this important question which would supersede the necessity for individual care by the occupiers of houses against the risk of fire ; no precaution can prevent the occurrence of fires, nor can any public measures be enacted which could or should prevent individuals from suffering losses from those acts of carelessness from which fires generally arise ; public measures can only be of real service in arresting the progress of fires when they occur, and in preventing the enormous losses which arise from allowing a fire to attain to any considerable dimensions.

"Nor can any legislative enactments be made which would probably prevent the necessity of fire brigades being still maintained at the cost of owners of large properties, such as the docks ; it may even be reasonably questioned whether the owners of large properties, where goods are peculiarly exposed to risk of fire, ought not to make some special protection for their own property ; for if a system of rating were observed on the same plan as at present exists for county police rates, the property in warehouses would hardly be charged a sufficient rate to entitle them to demand more protection than is afforded generally to other property throughout London ; if a larger degree of expense was incurred by the new fire brigade, especially for their protection, it would be only fair towards other ratepayers that they paid a larger portion of rates so increased for their special protection."

Sir George Grey did not give his approval to the suggestions of the Committee, as he thought the cost (£70,000 a year) far greater than the Government could be persuaded to provide for, and he asked for another plan, which could be carried out at a much lower expenditure.

Accordingly another plan of a brigade was submitted, the annual cost of which was estimated at £52,000. To this the Home Secretary replied, that if a further reduction were made so that the annual cost should not exceed £50,000, the Government would be prepared to support any member of the House who would bring in a private

Bill for the transfer of the brigade to such authority as might be selected.

This request was easily complied with by means of omitting some of the proposed stations, and reducing the number of men and engines.

It then became necessary for the Government to decide as to what public authority should have the charge of the new brigade. At first the suggestions of the Parliamentary Committee were considered, and it was thought advisable to place it under the control of the Metropolitan Police; but this was found to be impossible, as the Metropolitan Police had no powers within the boundary of the City of London. This idea was then abandoned, as it was out of the question that a separate brigade could be made for the City alone.

The attention of the Government was then directed to the Metropolitan Board of Works, and, after prolonged negotiations, it was at last decided that the management of the brigade should be made over to that body, and that the funds should be provided by a rate of one halfpenny in the pound, to be collected in the same way as the poor-rate and police-rate, and a contribution from the insurance companies of £35 on each million sterling of annual insurances within the Metropolitan area. The Government at the same time compounded for the rates on public buildings by an annual payment of £10,000, so as to avoid the trouble and inconvenience of frequent changes of assessment.

In the Parliamentary Session of 1865 a Bill was passed to give effect to these arrangements, and in accordance with its provisions the old London Fire Engine Establishment was transferred to the Metropolitan Board of Works on the 1st of January, 1866, under the title of the Metropolitan Fire Brigade.

The history of our country abounds with instances of the wonderful energy of private undertakings, but there are few records more remarkable than that of the late London Fire Engine Establishment which, without any legal

status whatever, on the contrary, in the face of the legal status of the parochial authorities, worked itself steadily through every difficulty, until it became a publicly recognized institution, reflecting the highest honour on the fire offices which organized and worked it.

During the thirty-three years of their administration the associated fire offices expended £530,545; their men extinguished 29,069 fires; and, when they gave up the brigade, they handed over gratuitously to the new authority the whole of their stock and plant, valued at £18,198.

The interest which the managers of the associated fire offices took in the Fire Engine Establishment, the skill and shrewdness with which they carried on their numerous difficult semi-diplomatic communications and negotiations respecting it, and the combination of kindness and strict justice with which they treated those in their service, constitute an honourable and enduring example of energy and success in private enterprise.

On the 1st of July, 1867, the Fire Brigade undertook the charge of the fire-escapes, which had previously been carried on by a charitable society; and now there are no less than 128 of these ladders distributed throughout the Metropolis every night, each fully equipped with all necessary appliances, and attended by a thoroughly trained and skilled fireman, who is visited at regular and irregular hours by a responsible officer.

Among the many improvements of late years, few have been more serviceable to fire brigades than the accelerated means of communication and inter-communication, provided first by telegraphs, and afterwards by telephones.

Formerly all messages were sent by runners, and in London this brought into existence a class of men and boys depending for a livelihood almost exclusively on this precarious industry, and consequently not of the most orderly habits or reputable character. Strange to say, however, their actual work was not badly done so far as they were concerned—that is to say, when they got a message to deliver from one station to another, they man-

aged to deliver it in about the shortest time possible under the circumstances, generally doing half a mile in a little over three minutes, a mile in about eight minutes, a mile and a half in about fifteen, and so on with proportionately decreasing speed for longer distances, in which fatigue became a prominent factor. Under such an arrangement, it will be readily understood that a long time elapsed before any considerable force could be brought together when required, and that heavy losses occurred in consequence. Then enquiries were made about the much-advertised telegraphs, at that time comparatively new and not very much in use; but many difficulties presented themselves. Everything connected with telegraphs for private or special purposes was in the hands of speculating companies, which spent the greater part of their capital in advertising against each other, and had very little left for executing orders, and no good staff of educated electricians and engineers to enable them to do the work satisfactorily. The instruments were complicated in their construction, uncertain in their action, and required special skilled practitioners to work them, and in consequence the cost was almost completely prohibitive.

In these days it may raise a smile to recall the wild exaggerations and feverish solicitations of the early telegraph touters of every class and kind, from the needy broken-down merchant's clerk to the commercial member of Parliament, and even, if one may be profane enough to mention it, the speculative peer. These differed in many essential points, but they were all alike in their perfect and complete ignorance of everything connected with the real business, such as electricity, engineering, and even the commercial aspect of the undertakings. The result was that which might naturally be expected from such conditions; the work was badly done; the cost was exorbitant, and those who anxiously looked forward to improvement found themselves helpless before the phalanx of interested imbecility.

There is, perhaps, no point on which the common touter,

whether of high or low degree, makes greater mistakes than that of explaining to others their own business. For instance, he spends hours in telling a fireman of the advantage of quick communication between fire-engine stations, especially when life is at stake, and persists in explaining that a liberal community is always ready to spend money for saving life, &c., &c., &c., and there ought to be no limit to expense in the attainment of such an object, all of which is mere vapid word-making, unless it includes also what can be done for the same money in other ways.

How these well-meaning, but unbusiness-like and unintelligent gentlemen threw back the question of telegraphic communication at that time, it is painful to remember; but progress can only be delayed by stupid persons, it cannot be altogether stopped, and after long waiting and intervals of blank despair, the day at length arrived when telegraphic communication with alphabetical instruments was established in London between the head-quarter station and those of the four superintendents. This was a great event in the history of the brigade, and it proved its own justification.

An extension from the superintendents to all the district stations shortly followed, until a complete system was established throughout the whole brigade. After this many of the stations were surrounded with lines of call-points, at which any one can ring and call the engines without going all the way to the station, and this, although occasionally harassing the firemen by false alarms, has proved an inestimable benefit to the inhabitants.

The next change was from telegraphs to telephones, and this has proved the greatest boon of all.

In America the telegraphic communication, which is very elaborate, is worked by a special body of electricians, paid by the fire departments, but not belonging to their working staff; but in London it is exceedingly simple, and is worked by the firemen only. There is a great difference between the two systems, but each probably suits the place where it is adopted.

In America the firemen are not trusted to do what is necessary in case of an alarm of fire. Everything is done for them, on a system previously arranged without regard to special circumstances.

At the first ringing of a certain bell on one of the fire alarm circuits, certain engines named on a card in connection with that bell proceed to the spot indicated; on the second ringing of the same bell certain other engines named on the card proceed; on the third ringing certain others, and so on; but there seems to be no certainty that the second and third calls are in any way different from the first, all alike perhaps coming from individuals suffering under some of the usual forms of excitement, but in any case having no reference to the wishes or wants of the experienced firemen who first reach the scene.

Everything no doubt can be corrected later on, but not until the mischief has been done; and it has happened that engines have arrived from distant places long after the first had returned to their stations. This causes endless worry to the firemen, and heavy expense to the department; but, so long as the firemen are not trusted to know their business, it will no doubt continue.

In London, when a call is received, the officer of the station called immediately proceeds with his engine, and the superintendent of the district at once sends on whatever help he in his discretion thinks proper, the chief of the whole at the same time sending or not sending further help as he thinks fit; and on the arrival of the first engine at the scene, the officer despatches back a messenger conveying his views as to the nature of the fire, and this message determines those at home as to whether further aid beyond that already despatched shall be sent or not.

Thus, in America, for the purpose of insuring that there shall not be less than a certain attendance for every call, engines may be despatched when those in charge of them know all about the fire and are perfectly aware that their services will not be required; but, on the other hand, the authorities desire to make sure that, in the event of a real

disaster, there shall be a sufficient attendance, and no doubt the system accomplishes this result.

In most cities of England every fireman is supposed to know his business, and to be able to say exactly what the attendance ought to be; and, however strange it may seem to others, it is almost certain that in the general way no mistake is ever made; but the message from the first officer arriving at the scene is the most important part of the arrangement, and in the very rare event of a partial error is quite in time to make everything right.

With regard to a fire itself, the circumstances are probably very different from what the world at large might suppose them to be.

A fire is discovered by an inmate or a passer-by, it may be a policeman, who gives an alarm and then either goes or sends to a fire-engine station. The bell is rung, and at once answered by the men on duty, who satisfy themselves that it is a real and not an imaginary appeal for help (this should never occupy more than five seconds), and then immediately harness the horses to the engine, and start for the scene of the occurrence; the time occupied in answering the bell, asking for particulars, harnessing the horses, and getting away varying, according to circumstances, from about one to three or four minutes. Then comes the journey, which with good horses is done at the rate of about a mile in four minutes.

Should the time be later than eight in the evening in winter, or nine o'clock in summer, the call would also go to a fire-escape station; the fireman in charge would instantly turn out, and would have the machine moving towards the scene of the fire in less than one minute; would travel at about the rate of six miles an hour; and as the fire-escape stations are much more numerous than the fire-engine stations, and consequently have shorter distances to travel, he would probably arrive before the engine. This, however, only happens at night, as the fire-escapes are not kept in readiness after six o'clock in the morning in summer, or seven in winter.

On arriving at the scene of the fire, the fireman in charge of the escape searches the building as much as in his judgment seems right or necessary, and if he sees persons requiring aid, or hears that there are persons inside, he makes every possible effort for their safety.

The skill and resolution required for this work are of a very high order ; but it is hardly too much to say that, so far as London is concerned, there is not an instance to be found in which those charged with the duty have proved unfaithful to their trust. On the contrary, the death-roll of the firemen is for the most part a simple record of lives well lost in the faithful and rigorous discharge of duty.

But to return to the subject of the fire. When the first engine arrives, and the officer in charge has heard from the fireman with the escape, or seen for himself the state of affairs, if it is necessary to get to work, he gets his branch as near as possible, and keeps always moving forward, unless, as sometimes happens, he is driven back, in which case he still uses all his efforts to get on, and always takes care to occupy the nearest available spot from which he can command the fire.

The others which come after, if necessary, do the same from the places most convenient for preventing the fire from spreading, until the whole has been surrounded. In short, a fireman's whole business is to get his men inside at every available point, and his success or failure in stopping a fire depends almost entirely on his being able or unable to do this. But the difficulties in his way are sometimes formidable.

A case once occurred in which the smoke was so dense, and beat downwards so violently into the street, that nearly twenty minutes elapsed and ten or twelve engines arrived, some of them from stations three miles away, before the fireman with the first escape or the officer with the first engine could ascertain on which side of the street the fire was burning. There are few cases as bad as this ; but at the commencement of a fire smoke is often a serious obstacle to firemen.

When there is no smoke or obstacle to prevent them from getting in, they get each engine to work as it arrives, enter the building at every available opening, and push on vigorously towards the centre or seat of the fire.

After the firemen have been working for some time from different directions, and always advancing, the welcome sound of "Drop your water short" is heard, and then the beginning of the end is known to have arrived. Soon this is repeated from several quarters, and the men become aware that they are rapidly approaching to the centre. After this they see each other, or perhaps each other's lamps, and then as a rule the fire is over, and all danger of its spreading at an end, though there may still be much work for the firemen to do in turning over stock and cooling it.

This refers to a case in which the firemen are successful in dealing with premises thoroughly on fire before their arrival; but there are many in which, through the lateness of the call, the great inflammability of the stock, the weakness of the building, or some other cause, sometimes all these combined, they know on their arrival that entry is impossible; and then the premises are doomed, and the firemen use all their energies for the preservation of the surroundings.

The end and aim of real firemen is to get close to their work, and their efficiency may always be measured by their success or failure in accomplishing this. It is true that in individual cases this is no certain test, as circumstances, such as some of those already indicated, may be against them; but the power of getting close and the habitual exercise of this power are infallible symptoms of efficiency, and for this purpose the appliances must be strong and light, and the firemen must be thoroughly practised in their use both when working singly and in combination.

It is in these essential points that the most remarkable differences are to be observed between the new and old countries. In America everything appears to be sacrificed

for strength, and on the continent of Europe everything for lightness, and to such extremes have they gone, that some of the recent American inventions would, if adopted, have the effect of mooring the firemen on the ground level, at a distance from their work, while some of the European would enable the men to reach the high levels and approach their work quickly, but make them of little use when they get there.

The variety of stocks to be dealt with in case of fire in large commercial and manufacturing cities has for many years been steadily increasing, until it may be said that every large centre of commerce now contains every possible element of risk, from goods merely dry and inflammable to volatile oils and spirits, and even stocks either in themselves highly explosive, or capable of becoming so under the influence of heat.

Perhaps there is no subject generally less understood than that of inflammable liquids in a state of combustion. It is quite true that oil, melted grease, and most spirits, are lighter than water, and, when not interfered with, will float to the top and continue burning; but, on the other hand, it is to be remembered that no liquid can burn at a temperature below that of its own boiling point, and that no matter how fiercely it may be burning on the surface, when a sufficient quantity of water has been forced into it below to reduce the temperature of the mass sufficiently, the fire must then cease.

To take an extreme case, if a thousand gallons of oil, melted grease, or other highly inflammable liquid, are burning fiercely in an enclosed iron vat or sunk tank, and one gallon of water is poured in, this will go quickly to the bottom and the fire will continue as before; but if in the same tank one gallon of liquid be on fire and a thousand gallons of water poured on, the temperature of the burning liquid will be instantly reduced below its own boiling point, and the fire will consequently cease.

These inflammable liquids are among the greatest difficulties with which firemen have to contend, particularly if

under the influence of heat they give off gases which, with a certain admixture of atmospheric air, are highly explosive; but the more these difficulties are studied, the more easily firemen can cope with them.

It is serious when the firemen have, without effect, poured in so much water as to bring the burning liquid near the top and then have to stop lest it should overflow and set fire to the whole neighbourhood; as, when the water ceases, the vat itself may split with the heat, and spread the flames; or the walls of adjacent premises may vitrify, or perhaps crack and allow their contents to be piled on the fire. But there are many ways in which these dangers may be partially averted. The earth about the vat may be loosened by means of crowbars and saturated with water, reducing the temperature of the metal, and strong jets of water may be thrown on the adjoining walls to keep them cool.

There are cases when earth and sand prove very efficacious, but these substances cannot be projected far or used in large quantities, and, moreover, they have little or no effect on deep masses of burning liquid. The paramount object is to keep the liquid within proper limits, and, if necessary, allow it to burn itself out there; but of course when firemen are quite certain that there is no danger of an overflow, they proceed to extinguish the flames by reducing the temperature, and this, as already explained, though requiring judgment and discretion, is but a question of proportions. It is not safe to pour water on the hot sides of a vat; but it may be safely driven into the centre of the burning liquid, and when enough has been put there to lower the temperature sufficiently, the fire goes out of itself.

To give a very simple instance of the effect of heat and flame on certain substances: A mass of tallow may be raised in temperature to its melting point, and a lighted match applied to it, but it will not burn. It may then be further heated until it reaches its boiling point, and on the application of a light it will instantly burst into flame. It may then be cooled down to below its boiling point in any

convenient way, as by cold applications from without, and it will cease to burn without anything being done to the flame; and, lastly, it may be thrown into cold water, when it will be found to have resumed its original condition as tallow.

These are the actual changes which firemen observe in the event of success, and they are not the less worthy of study because they do not often happen as here described, or because firemen do not always succeed in extinguishing oil and tallow when once thoroughly on fire.

These substances, no doubt, are formidable enemies to a fireman, but the more he thinks about them the less he fears them, and there are numbers of cases in which they have been fought with most satisfactory results.

But a more trying case sometimes occurs, when the firemen on their arrival find the whole place in flames and the walls buckling out. When this happens, they have to mount all the adjoining and surrounding premises, and work from these into the building on fire, which is then almost certain to be destroyed.

In buildings which have been much cut about, or the walls of which have been altered or undermined, this is a common occurrence; but it is one which every fireman has to face, and his only chance of safety is to be very watchful and very quick in his movements.

Instances innumerable could be cited of a large warehouse on fire swarming with firemen—perhaps ten or twelve on every floor from the basement to the roof—and a notice that the walls were cracking being sent from outside, in time to get the whole party not only out, but out of range, and even in many cases bringing their gear with them; but this can only be done by men with cool heads and strong limbs, well practised in working together, and with entire confidence in their officers, and in each other.

As the fire proceeds the firemen approach in every direction, in front, at the back, by the stairs, through the windows, over the roofs of adjoining premises; and in very narrow streets, such as those of the wealthiest part

of London, it very commonly happens that they have to direct the water from opposite premises in order to cool the windows which their comrades are entering by means of ladders.

The difficulties of obtaining water for each engine on its arrival, of laying out the hose, pitching the ladders, breaking into the building itself and those adjoining, mounting the stairs, the roofs, the ladders with all the necessary appliances, and directing the water where it is most required are frequently very great; but even in the densest and most excited crowds, and in the face of flames so hot that the stones of the pavement crack, and lead is pouring down like water, they can be overcome, and as a rule they are overcome by well-trained resolute men.

There are occasions on which the building on fire can only be approached on one side, and this is detrimental to its own safety, though generally favourable to that of its neighbours; but in certain parts of all very old cities constructed before Building Acts were thought of, there are to be found buildings of tarred wood and other inflammable materials which obstruct the entrance of firemen, and at the same time add fuel to the flames.

This is the point on which the principal cities of America stand in such an exceptionally favourable position, having all, without a single exception, been constructed under the most stringent regulations, framed and carried out by commissioners composed of distinguished persons appointed for this special purpose, and in every case acting under the same municipal or other local authority which controls the fire department and the water supply.

When old buildings are found to lend no aid in retarding the fire, but seem rather to increase its intensity, the fireman's task becomes more difficult; and when in addition to this they are heavily stocked with highly inflammable stores, and sometimes even with explosives or with goods which under certain conditions become explosive, the case is occasionally very serious.

Not long since a fire occurred in a warehouse heavily

stocked with jute and other fibres packed in bales, and the stock swelled with the heat until it first closed all the passages or gangways left for the trucks to pass through, and then burst its own walls out, smashing the ladders on which the firemen were working, and seriously injuring the men.

In another case a large party of firemen had been working inside a building, and had virtually subdued the fire, when some symptoms of weakness in the floors became observed, and the men were ordered out, but, before the last two or three had got clear, the whole of the inside fell down into the basement, and only the roof and outer walls remained. This was clearly a fault of construction, the floors not having been sufficiently supported in the walls; but then the warehouse had been constructed before the adoption of building laws, and it is to be supposed that such a catastrophe could not occur in any part of the old European cities which has been built within the last 150 years, or in any city whatever of America.

Another case of difficulty may be mentioned, one in which there was a combination of several of the worst obstacles to a fireman's success. A fire occurred in a set of buildings, all adjoining and communicating, and heavily loaded with oil, grease, and saltpetre. The firemen after a hard struggle succeeded in getting in on every side, and on every level, when a series of explosions commenced, in consequence of the saltpetre and the charcoal of the burnt wood coming together and being touched by the flames. In several parts the firemen were unable to hold their ground, and heavy loss resulted from their withdrawing, but it was unavoidable.

In another case a fire, which had raged fiercely in a large warehouse, was well under control; firemen occupied every point from which they could do good; some were on ladders working through the windows, both at back and front, some on adjoining roofs working down, some on opposite buildings working across a narrow street, and under the cover of this external aid a large party had forced

their way inside, and were holding their ground well on several floors; when, without any warning, a body of flame burst through all the front windows simultaneously, and completely enveloped all the men on the ladders at that part, who were, of course, severely scorched and otherwise injured, and in fact escaped with their lives only through their own skill and smartness, backed by the resolute and unflinching support of their comrades on the ground. In this case, which was somewhat serious, it happened strangely enough that none of the officers or firemen working inside received any injury whatever.

The fire which took place in Wood Street, Cheapside, in 1882, offers a remarkable illustration of the rapidity with which immense, and apparently substantially built warehouses, come tumbling to the ground when subjected to the action of intense heat and flame. Stone and iron entered largely into the composition of nearly the whole of these buildings, and the walls and roofs were pierced in all directions to obtain space for windows and skylights.

This fire commenced in an oblong block of warehouses, bounded on the east by Philip Lane, with a frontage of 380 feet; on the west by Wood Street, with a frontage of 380 feet; on the north by London Wall, with a frontage of 150 feet; and on the south by Addle Street, with a frontage of 180 feet.

The total area of the block was 62,700 square feet, or nearly an acre and a half. This block was situated in the very heart of the city of London, and many of the premises were warehouses of six floors, about 65 feet high. The place was hemmed in on all but the north side by exceedingly narrow thoroughfares, Wood Street being only 20 feet wide from wall to wall, Addle Street 12 feet wide, and Philip Lane 16 feet, and the block comprised in all 36 buildings.

The fire was first discovered at 2·48 A.M. in a wholesale hosiery warehouse in Philip Lane, by a police constable, who instantly ran off with the call to a fire brigade hose-cart station, in close proximity to the place. At this point there is a fire alarm post, which communicates with a large

fire-engine station, distant 480 yards from the fire. This alarm was rung, and the firemen on the spot immediately attended with the hose-cart, and, having attached a line of hose to the nearest available street hydrant, commenced pouring water on the fire, at the same time, according to the usual custom, despatching a message to the nearest station with particulars.

Owing to the close proximity of the hose-cart station, the whole of these operations did not occupy more than three minutes. The engine from the nearest station immediately attended, and the call was passed round the whole brigade, and resulted in the attendance of 26 steam fire-engines in the shortest possible time ; but some of the more distant engines had to come as great a distance as four or five miles.

The engine from the nearest station was of course the first to arrive, and the hydrants were at once got to work, all giving most satisfactory jets. At this time the warehouse in which the fire was first discovered was completely on fire throughout ; flames were coming through the roof, and had also communicated at the back to a large new building belonging to the same firm in Addle Street and Wood Street.

Five houses occupied by other firms intervened between those in the front part of Addle Street and those in Wood Street, and there was also a public-house at the corner between the premises on fire in Addle Street and those in Philip Lane.

All the engines as they arrived in quick succession were at once set to work, and after a time it became necessary to knock off the hydrants, as the opening of a great number had reduced the pressure.

It will perhaps give some idea of the rapidity with which this fire spread after the constable had first discovered it, when it is mentioned that many of the distant stations of the Brigade were called by passers-by for the light, before it was possible to get the telegraphic messages through to them.

It was not only that masses of inflammable goods loaded

every one of the five or six floors of each of these warehouses, but the floors themselves were spacious, and afforded free play to currents of air, and long staircases and skylights acted as blowpipes and provided copious draughts.

From the nature of the business carried on, each of these places was a perfect labyrinth of rooms and stories; many of the warehouses communicated with one another, though in most cases they were supposed to be completely isolated at night by strong iron doors. As a matter of fact, these iron doors were little or no protection; one after another they became red hot, and by their expansion dislodged the stone or brickwork of the walls, and then the flames rushed through and gained a complete mastery from front to back and from basement to roof. The expansion of the iron girders and columns forced out the walls, and speedily completed the destruction.

A strong wind was blowing at the time, and carried the flames with great rapidity from one building to another on the inside, in parts which it was impossible to reach quickly from the outside.

In this part of London generally, and especially in the block in question and some of those surrounding it, buildings of large area and great height are crowded together in such close proximity that, when flame comes out of any street window, it instantly strikes the front of the opposite building.

They are also constructed in such a way that, when a fire begins to burn in any spot away from the street fronts, it goes on burning on several levels together, and while the firemen are occupying one or two of these levels, the fire is striking out above and below and on every side of them; so that, to deal properly with one of these buildings, there should be a strong force of firemen on every floor at the same time, which in the case in question, owing to the complicated nature of the stairs and passages and the rapidity with which the fire spread, was altogether an impossibility.

To give some idea of this, it may be mentioned that, on breaking into one of the houses on the Wood Street front, which showed no external signs of danger, the firemen found the whole building inside like a roaring furnace; and then it became evident that the greater portion of the block was doomed, and that it would require every effort on the part of the Brigade to save the rest and the surrounding property, which was nearly all of the same description.

In a fire of this magnitude there was necessarily a great deal of moving about, and when the walls began to show signs of falling the firemen had to be removed, and it soon became necessary to shift all the branches along the Wood Street and Addle Street fronts into the upper windows of the buildings opposite; this was just done in time, and within a few minutes after they were shifted about a hundred feet of the Wood Street wall fell outwards, of course burying every line of hose which lay along that part of the street.

This was an accident for which the firemen were fully prepared, and the shortest possible time was occupied in laying out fresh lines, but it need hardly be mentioned that the laying out of some six or seven thousand feet of hose is not done without a loss of many minutes.

Shortly after this it became necessary to remove the men along the Philip Lane front into the windows and high levels of the buildings opposite, and owing to the narrowness of Philip Lane and the intense heat at that part, this was a matter of difficulty and danger; indeed, one of the houses at the opposite side was actually burned out, owing to the falling wall on the opposite side breaking the front in and driving the firemen away to some distance. Again, towards the north end of Philip Lane there were two engines at work, and these were kept in their position for a long time, notwithstanding that the heat at this point was very intense. After a time, however, the warehouse wall opposite began to show signs of coming away, and then an order was given for these engines to be withdrawn, and

this operation was only just completed when the wall fell out, covering the whole street, smashing in a portion of the front of Sion College at the opposite side, and damaging the last of the two engines which had not yet got out of range.

The firemen then occupied every available position at a portion of three sides, chiefly from the windows of the opposite houses, and, for the remainder, over and through the other houses of the block.

For about three hours this fire raged with great fury, and owing to the enormous heat which it generated, put all the surrounding buildings in imminent danger.

At the end of that time, however, the efforts of the firemen began to tell visibly, and in about two hours more, or altogether about five hours from the commencement, all danger was completely over.

Of the thirty-six buildings comprising the block, twenty-three were destroyed, three seriously damaged, and ten slightly damaged, and the fronts of all the opposite premises at every side were badly scorched, and had most of the glass broken.

The total force engaged in extinguishing this fire was seven hose-carts, six manual fire-engines, twenty-six steam fire-engines, two fire-escapes, five vans, seventy-four horses, and 168 officers and men.

There were many casualties among the firemen in the way of cuts and contusions, and a great many very narrow escapes from falling buildings, and one officer died a few days after from the effects of the extreme cold and exposure.

This was a serious affair, but it might have been much worse; and, great as the loss was, the firemen will have cause to be thankful if on the next similar occasion they succeed as well. They are thoroughly acquainted with this part of London, and know well that it contains all the elements of a gigantic fire, and will probably bury a number of them yet, which indeed is one of its worst dangers, as many minutes would necessarily elapse before

others could arrive to take their places, and in the meanwhile the fire would rapidly spread.

It is usual to hear of the advantage of stopping the course of a fire by pulling down or blowing up buildings, and it is not difficult to imagine cases in which this kind of operation might prove useful; but there have been very few in which it has been actually used, and still fewer in which it has been of any avail.

The official account of the attempts to stop the Boston fire of 1872 by the use of explosives is a melancholy and humiliating record, and the few others which can be found are all of the same character.

Most fire brigades have the power of pulling down, and all, whether they have the power or not, have probably done it frequently, though on a very small scale; but as a rule firemen would prefer to build up, if this were possible, and in crowded localities the pulling down or blowing up of a heavily stocked building would be a most serious operation, and one certain to be attended with great danger and enormous loss. It would be somewhat like a burning oil-tank overflowing and setting fire to everything the oil could reach.

The theory of pulling down or blowing up is that a separation would be effected, and, wherever the operation can have this effect, the theory is right enough; but, when it is reduced to practice, the question arises as to how the annihilation of the stock is to be brought about. Firemen sometimes pull walls down, not because they want to scatter the contents of the building, but because the walls have been shaken, and are likely to fall and kill some one. As a skirmisher of an army can shelter himself under a mound of some 18 or 20 inches high, so a fireman can do wonders behind a foot or two of wall.

Frequently the firemen make shields for themselves out of iron plates which they find on the premises, and under cover of these little screens, not a yard square, approach within a few feet of flames which they could not otherwise face. Thus it will be seen that in the general way

a wall so long as it stands well on its own legs, as a respectable wall should do, is the fireman's friend and not his enemy, and that, even in an empty building, to remove it during a fire because it happens to be inconvenient for a moment would be somewhat like a man cutting his head off to save the trouble of shaving; while in a heavily-loaded warehouse such an operation is fortunately impracticable, and, if it were practicable, would be highly dangerous.

Firemen have many difficulties to contend with, and that of dealing with great depôts of merchandize in close contiguity is one of them; but their way of meeting these is not to remove here and there a warehouse with a thousand tons of stock inside it. They must provide themselves with large quantities of strong light appliances, and, in proportion as the warehouses become larger and larger, they must become quicker and more active.

At the present rate of progress the day cannot be far distant when firemen may be compelled to say that they are unable to deal with the vast masses of property which merchants insist on bringing together within one risk; but it is hard on a fireman to have to own himself beaten, even when he knows he is, and it is still possible that in the end the quantity of stock massed together in one risk will be limited, not by the warnings or appeals of firemen, but by the self-interest of merchants, when they find insurance-rates prohibitive.

But in the meanwhile the world must progress; commerce will not stop for firemen or any other class; and those practically interested know perfectly well that the occasional killing of a few firemen would count very little against the advantage of bringing plenty and prosperity to the doors of whole masses of the population. In a word, as long as it is commercially advantageous to collect large quantities of property together in one risk, so long this will be done; and it would be both senseless and selfish on the part of firemen to attempt to interfere. Reasonable warnings they are bound to give, and risks of every kind, reasonable and unreasonable, they are bound to incur—this is their

raison d'être in the world—but they must take care not to go too far and make themselves a nuisance, which they certainly would do, if they attempted to dictate to merchants, who know their own interests best, and would simply commit professional suicide in submitting to undue restrictions.

A ship on fire at sea sometimes plays strange pranks. When a fire is discovered, every effort is made to stop all draughts, and this is generally accomplished by running the vessel before the wind. But there are exceptions to this rule, and a notable instance is that of a 1200 ton sailing-ship, which was put before a strong gale under these circumstances, when it was found that below decks the wind blew with considerable force from bow to stern. The ship was brought to the wind, when the same conditions prevailed, and she was once again put before it, but only with the same result. It was then determined to furl the courses or lower square sails, and after the main and mizen courses had been stowed there was still no change. At last they got to the fore-course, and, as soon as this was clewed up, the draught ceased, and the sailors were able to get below and extinguish the fire.

All good captains know how to stop or check draughts in their own vessels, but there is no general rule on the subject, and certainly running before the wind, though most frequently attempted is by no means always successful. Many circumstances contribute to the result of a fire on board ship, the shape of the vessel, the quantity, nature, and position of the cargo, the discipline of the crew, the condition of the fire-extinguishing appliances, but, above and beyond all these, the head and body of the man in charge.

Only those who have had to face a fire at sea know what a circumstance it is—one requiring every quality and faculty of a man—and it is much to be regretted that more notice is not taken of those who have been successful in saving their ships. The tendency appears rather to be in the direction of censuring them for allowing their ships to

catch fire, than of praising them for extinguishing it after it has commenced.

Of course in the generality of cases a captain is supposed to control everything that happens in his ship ; but he cannot have his eyes everywhere, and he can hardly be held responsible for what happens in the galley or the passengers' cabin when he is on the deck, or for spontaneous heating of coal and other cargo which he had no hand in stowing and which the owner knew to be dangerous.

Ships have been brought safely into port after the cargo has been fifteen or twenty days on fire, the decks nearly turned into charcoal, and the captain and crew looking like chimney sweeps after their desperate struggles. These men wash their faces and go away to their homes almost unnoticed, certainly not claiming to be noticed, perhaps not even conscious that they have done anything worthy of notice, and yet they are of the kind which in another service would be justly rewarded with a Victoria Cross.

But whether their merit be publicly recognized or not, all true firemen on shore must hail them cordially as brothers, and esteem them as men showing the highest form of determination and devotion under circumstances of exceptional difficulty and danger.

The firemen of cities witness such scenes only in their travels ; but in rivers and docks they have to deal with cases of ships on fire which often give much trouble though in a different way.

A loaded ship of perhaps 1000 or 2000 tons is left under the charge of a single ship-keeper in a tier with other vessels, and a fire breaks out on board ; an alarm is raised, and presently a floating fire-engine comes up. The fire turns out to be in the bunkers, and both inner and outer sides become red-hot. The other ships are in danger from the outer sides, and the chain has to be unshackled and the vessel towed away, the fire-engine all the time working hard and pouring water on every spot which can be reached. The firemen swarm on board, and once there,

are seldom driven back. They try to flood the deck; and they work their water on the rigging and the sails; but, owing to the smoke and intense heat, they cannot always reach the desired spots. Then by degrees they feel a hatch near them, and though blinded with smoke and almost suffocated with heat they manage to burst it open, and get some water down.

This goes on for a time, and by degrees another and another branch are introduced, until a sensible diminution of the heat has been effected, when the firemen get inside, and then the real difficulties begin. The inner sides of the bunkers being still red hot, if any water touches them it is instantly turned into steam, which scalds the men, and yet some water must get to them. The men are relieved after about three minutes below, and their places taken by others, who in their turn are relieved, until the first party go below again; and this continues until the ship's hold is cool enough for getting at the cargo, when all spare hands go down and work away until everything in the hold has been turned over or passed on deck to be doused out with buckets.

In one case a party had gained access to the gallery of the engine-room, where the heat though very great was not intolerable; but the chief, who now owns that he should have known better, incautiously ordered the water to be poured on the red-hot bunker-plates, which had the effect of very nearly scalding himself and all his party to death. But these are casualties to which all firemen are liable.

Persons who have no practical acquaintance with the subject talk of scuttling a vessel as an easy matter; but there are few more difficult operations, unless, indeed, a cannon may happen to be at hand and a man to work it, in which case no doubt a ship can easily be scuttled, but she will probably at the same time be destroyed. For ordinary scuttling, it may be said that with an iron ship it is simply impossible if a hole has to be cut. The whole of the cargo and inside may be burned out in less than an

hour and nothing left, while it would take good men with good tools at least six hours to cut the necessary hole.

With a wooden ship the case is different, but even then the difficulty is very great, as the fire is every moment lightening the vessel, and a hole commenced between wind and water may, when completed, be a foot above the water line. In a well-built 1500-ton wooden ship it would be good work to get a sufficient hole cut in an hour.

The usual way of dealing with a vessel in dock is to get all topgallant and royal halliards on shore at one side, and heave them down with such help as can be obtained; then to get the scuttling tools to work between wind and water at the other side, and when the hole has been completed, to shift the halliards across, and heave her down at the side on which the hole has been cut, and so get the water in; but this is a work of great difficulty, and can only be accomplished in the weaker kind of ships. Large first-class sea-going vessels are very difficult to pierce with any scuttling tools at present in use. In London, the most common course is to fill the compartment with water to the deck; but there are not many places in which the appliances would enable the firemen to do this.

It is a rather interesting sight to see a vessel towed out of a tier and extinguished at the same time. The firemen of the floating engine lift the chain until they come to a shackle, when they knock the pin out, and make fast a rope to one of the links and tow away, the pumps working all the time aud driving water in all directions over the spars, rigging and top sides. By this time another floating engine, or several others, may have come up, and they all clap on where they can, either with ropes or, if the sides are red hot, with chains or iron hooks, their pumps driving water wherever it will reach. Word is passed from the first engine which is ahead that a mast shows signs of leaning over to starboard, which means that the heel below deck is being burned away, and immediately the engines on the starboard side cast off and come round to the port side, which is not done in less than a certain

number of minutes, before the expiration of which the leaning mast has fallen over to starboard, carrying everything before it. Some moments later the engine ahead hails again, this time to say another mast is leaning to port, and all the engines have to shift round to starboard, in the midst of the wreck and hamper of the first mast, and, just as they get clear, the other mast falls to port. Then the firemen begin to swarm on board, and soon the work is done.

The question of official investigations into the causes of fires arises periodically in England, but nothing is ever done with it. A few articles appear in the newspapers, and there the matter ends. The fact is, that investigations cost money, and that heavily taxed communities are unwilling to increase their expenses. They seem to prefer an occasional growl against some imaginary authority (really themselves) to a payment in cash to an actual rate-collector; and taking all the circumstances into consideration, it is quite possible that they may not be altogether wrong.

Certainly an increase of paid officials, merely for the purpose of investigating the causes of fire, without in any way reducing the material losses resulting from it, would be a serious matter, unless, as some affirm, not without reason, the existence of such officials would itself act as a deterrent to the fraudulent or criminal, and as a stimulant to the negligent or thoughtless.

As it is, almost everything is left to chance; no public official has the right even to investigate beyond a certain point, and doubtless many a criminal escapes.

Something, however, is done. The Fire Brigade officer in charge, before leaving the scene, makes every possible inquiry in order to discover the circumstances that led to the fire; but the result is in many cases without effect, the number of fires in London for which a cause can with any certainty be assigned being only about 80 per cent. of the total number, leaving some 20 per cent. unaccounted for.

Many have recommended that a strict investigation should be made by responsible officials having power to examine witnesses on oath, but a careful consideration of the subject will show that the universal adoption of such a course would be surrounded by many difficulties.

The time occupied in these inquiries, and the consequent expense, would be simply enormous, and the money might perhaps be more profitably laid out on stations, firemen, engines, and extinguishing appliances of every kind. The constant trials would absorb the whole time of all concerned, both sufferers and firemen, and would occasion an almost complete stoppage of their business.

Perhaps it ought to be explained that the term "sufferer" is applied by firemen to the owner of property damaged or destroyed by fire, and the term "customer" to those who have had more than one fire.

There are undoubtedly many members of every community whose private business would not bear the light of an official inquiry. The persons concerned might be perfectly innocent of any unlawful action in connection with the fire, but they might all the same be irretrievably ruined by the exposure of their affairs.

The curiosity aroused might also prove disagreeable, and there would be great danger of such inquiries being made use of for the pecuniary ends of those commercially interested in opposition—in short, their rivals in trade. Many would take such an opportunity for bringing forward any unpleasant circumstances concerning the career of the sufferer, and, under cover of giving evidence, spreading slanderous reports.

In the City of London and the Borough of Southwark in 1845 special fire inquests were held by the Coroner on the causes of all fires which were thought to be doubtful in their origin. These inquiries were carried on until the beginning of the year 1850, and were then discontinued, as it was found by the authorities that the amount of money expended far exceeded the importance of the results, and there was understood to be some doubt as to the strict

legality of the proceedings, or of the payments rendered necessary by them. It was said at the time that although perhaps inquests might legally be held, there was no fund out of which the expenses could be paid except in the event of loss of life.

From the year 1845 to 1850, 71 fire inquests were held, with the result that 9 fires were found to have been wilfully caused, 34 to have been accidental, and in 28 cases no conclusion at all could be arrived at. In 4 out of the 9 cases the persons implicated were prosecuted, but out of the 4 there was only one conviction.

All who have ever studied the subject have given their opinion that a power of some kind should exist for holding investigations concerning the origin and circumstances of fires; but no satisfactory solution of the difficulties surrounding the question has been proposed. An investigation in every case would prove an unmitigated nuisance, and involve prodigious expense.

Taking, for instance, London, with over 2000 fires in the year, and allowing the very moderate cost of £50 for each investigation, there is an annual expenditure of more than £100,000 a year, which about equals that of the existing Brigade. But, on the other hand, if an investigation is not to take place concerning every fire, where should the line be drawn? Should an authority be appointed to decide as to the necessity for investigating special cases? Should this authority be a court, a jury, an individual, or a consulting committee of police, firemen, and others? And, in the event of its being a court, should it be a fixed or a movable court? What would be the result of their action in the event of their deciding that an investigation should be held? What, in the event of this decision being acted on and proving to have caused damage to an innocent person? And lastly, should any limit be imposed on the power of the court to compel warehouse-keepers, dock-owners, wharfingers, and other agents to disclose the affairs of their customers?

These are only a few of the formidable difficulties which

seem to have overwhelmed every one who has hitherto attempted to deal with the subject of investigation.

Probably the simplest solution of the matter would be to appoint a salvage corps with a recognised authority, in conjunction either with the Fire Brigade or the police; but the expense of such an arrangement would also be appreciable, and the service rendered would be on behalf, not of the ratepayers, who would pay for it, but more frequently of the persons who, whether innocently or not, cause the fires.

It may seem strange that such a city as London should never have had a salvage corps; but when it is remembered that in the event of a fire there are at present several forces working independently, it will be seen that those who have experience would naturally hesitate to add another.

There are now the police, the water companies, the insurance companies' private salvage corps, and the Fire Brigade; and the addition of a public salvage corps might only cause confusion; but there can be no doubt that the time is coming when it will be absolutely necessary that some arrangement shall be made for the protection of the enormous quantity of uninsured property, which is stated by the insurance companies to amount to four-fifths of the whole, although other authorities estimate it only at one-half.

But whatever the proportion may be, there can be no doubt that the value of uninsured property in such a city as London is enormous, and that there ought to be some recognised body charged with the duty of guarding and otherwise protecting it after a fire.

During the past year or two firemen have been bitterly disappointed at the delay in establishing electric light in the great cities of England, which would have the effect of very considerably reducing some of the heaviest risks. This industry is probably travelling along the dismal road formerly trodden by the railways, the telegraphs, the telephones, and many other of the wonderful inventions which,

though they constitute the noblest characteristic and highest honour of the present age, have had to fight for existence from their infancy, and have eventually reached maturity only at the cost of total ruin to their originators.

To those who wish for progress there is no sadder thought than that arising from great enterprises destined to benefit the whole world for centuries being strangled at their birth, or so thwarted by the apathy, hostility, or mistaken spirit of governing bodies that the real benefactors are first worn out and ruined, and afterwards ignored. In the whole of Europe there is probably not one individual of any decent education who is not firmly convinced that within the next few years electric lighting will be enormously developed, and yet at the present moment there is not even a single section of any one city fully provided with this splendid benefit, or, to put it on the lowest basis, this magnificent inexpensive luxury.

Hundreds of companies have started up in every country of Europe, calling themselves by all sorts of high-sounding names; but not a single one of them has succeeded in accomplishing the professed object, that of supplying electric-light throughout a whole district from a central station in the same way as gas, although years ago the real inventor of practical electric lighting, Mr. Thomas Edison, of New York, did it thoroughly, and, as far as can be judged, apparently without an effort. This is one of the giants of invention—a man who with genius, determination, and singleness of purpose, has laboured in research and practical experiments until he has triumphed over every difficulty, and raised himself to a position unparalleled in our time.

The world at large considers this subject from separate points of view; a small but ever-increasing number from the practical scientific beneficial point; an important and also increasing number from the purely commercial point; and the great bulk of the people from the point of indifference or simple curiosity; but the first of these—the few who study and understand—place Edison on a pinnacle

high above his rivals; in other words, his imitators. They look on him as the man who has laboured and on the others as those who have entered into his labours, and they view with genuine sorrow the growing tendency to mingle together in common conversation the names of all concerned in electric lighting, the real inventor, the followers of the real inventor, the sham followers, the speculators and the stock-brokers, until the uninformed public sometimes fancy that the speculator is the inventor, and that the inventor is the stock-broker. Of course there is no remedy for this; but it is not on that account the less to be deplored.

Great inventors require the aid of capitalists, which naturally involves the co-operation of many others. This must freely and frankly be admitted by all who have any knowledge of business; but there is no valid reason why the name of an individual, a firm, a company, a syndicate, should be substituted, as has often happened of late years, for that of an inventor. America has been a serious offender in this way, and there are now in that country thousands of machines doing good work which are patented and claimed as American inventions, while they are really nothing more or less than adaptations of mechanical appliances which have been in use for years all over the world. In many cases—perhaps in all—the adaptation itself is a stroke of genius worthy of every praise that can be given to it short of a credit for originality; but the suppression of the real inventor's name is always a sort of dishonesty which it is very disagreeable to contemplate.

But no dishonesty of this kind in any one country can justify reprisals or revenge in others, and, in connection with electric lighting, the way in which a great name, *the* great name, is commonly treated in Europe as one of hundreds is a constant source of regret to all who understand the subject and are not commercially interested.

America has many reasons for honest pride, but none stronger than those in connection with electric lighting, which has actually been accomplished in that country, and

is at present working in factories, offices, and private houses with perfect satisfaction to all concerned.

It is no credit to Europe that there should be scores of electric-lighting companies which make no mention of the name of the real inventor, and themselves appear incapable of doing the work, or at least have never succeeded in inducing their cities to adopt their systems. To the man who by original research, by study, by prolonged labour and honourable industry has triumphed over all the difficulties surrounding this mysterious discovery, and carried it into execution with a brilliant and unqualified success, it must be somewhat aggravating to find that the work which has cost him a lifetime of heavy labour is undertaken by some "Smith & Jones's Royal British and Imperial Indian Electric Lighting Company Limited," or a "Société Anonyme Lumière Electrique de la Belle France et ses Colonies," using nearly everything that once was his except his name.

It will be a grave reproach to this generation if such a man as Edison finds himself compelled, in justification of his rights, to say, "Hoc opus feci; tulit alter honores;" but however this may be, those who take an independent view of the matter earnestly hope that the time is approaching when existing obstructions in Europe will be swept away, and this splendid industry allowed to enter on its inevitable development, to the great advantage of many who wish for good light, and all who are interested in the reduction of losses by fire.

Among the many casualties and misfortunes which happen in large cities, those arising from explosions cause the most wide-spread panic among the general population. An event of this kind seems to take hold of the popular imagination in an exaggerated form, and, though frequently the real danger is great enough, the scare is always greater still, and every kind of wild report is promulgated, until it almost seems as though under existing conditions the dangers of our time make a continuance of civilised life impossible; but these matters, when examined by the

critical light of practical experience present a very different aspect. It is true they are often very serious; but there is no reason for inordinate terror in connection with them.

One of the most common of these casualties is that arising from so-called gas explosions, and after any important event of this kind, the public is occasionally almost induced to believe that gas can never again be used for illuminating purposes, but this, like many other dangers, when calmly faced and thoughtfully considered, loses some of its worst terrors, and ranges itself quietly down into a sort of pro and con, debtor and creditor, advantage and disadvantage, and it may be well for all who live in cities to look into the matter a little for themselves.

So much ignorance appears to exist on this subject, and so much mystery to be always attached to it, that it is necessary to consider, first, what an explosion is; and secondly, what peculiarity there is in what is commonly called an explosion of gas to distinguish it from those ordinary explosions so well known, and in such common use for projecting missiles, dividing rocks, and other purposes.

The literal meaning of the word "explosion" is simply the act of driving out, accompanied by noise; and its ordinary meaning is bursting with force, or in other words, sudden and violent expansion.

The effects of an explosion are in exact proportion to its suddenness and violence, without reference to the material employed, whether gas, gunpowder, or any other substance.

The gas in ordinary use is the vapour which is manufactured by heating coal in iron retorts.

It is collected in inverted iron tanks or vessels called gas-holders, and, when purified from vapour of water, tar, and other substances, constitutes what is called by chemists carburetted hydrogen.

This carburetted hydrogen burns freely, with a clear brilliant light, but, when pure, cannot be made to explode. If it had ever, under any circumstances, been known to

explode, it would not be used for illuminating and other purposes in almost every large city in the world. The expression, therefore, "explosion of gas" is merely an erroneous form of speech, which has accidentally crept into common use, and been allowed to continue merely for convenience, and for want of a proper term or definition.

In order to create an explosion with gas, it is necessary to add to it a quantity of atmospheric air, in which case the substance which explodes is not gas, but a mixture of oxygen, nitrogen, and carburetted hydrogen, a compound essentially different from what is commonly known as gas; and the intensity and violence of the explosion are dependent on the relative quantities of these several substances.

The result of experiments made by applying fire to such a mixture as that here described, has been as follows:—The quantities of oxygen and nitrogen in the atmosphere being constant, the former being to the latter always as one to four, the air and gas only are given.

Per Cent. of Gas.	Per Cent. of Air.		
75	25	Burned away slowly in a glass cylinder without any explosion.	
66	34	Ditto	Ditto.
50	50	Ditto	Ditto.
34	66	Ditto	Ditto.
25	75	Burned quietly off with a feeble flame.	
20	80	Burned suddenly off with only a slight explosion.	
17	83	Exploded very suddenly and violently.	
14	86	Exploded most suddenly and violently.	
12	88	Exploded very suddenly and violently.	
11	89	Exploded less suddenly and violently.	
10	90	Still less suddenly and violently.	
9	91	Still less violently.	
8	92	Produced no explosion.	
7	93	Produced no explosion.	

On reducing the quantities of gas still further, no explosions were produced.

The following tables give the quantities in volumes instead of percentages :—

Gas.	Air.	
1	2	Burns slowly.
1	3	Burns feebly.
1	4	Explodes slightly.
1	5	Explodes suddenly.
1	6	Explodes most violently.
1	7	Explodes suddenly.
1	8	Explodes less suddenly.
1	9	Explodes still less suddenly.
1	10	Explodes still less suddenly, this being the lowest point of explosion.

One volume of gas with more than 10 of air produces no explosion.

Summary of the Foregoing.

Smallest quantity of gas to be mixed with atmospheric air in order to form an explosive substance.	9 per cent. or 1 volume in 10.
Greatest quantity	20 per cent. or 1 in 4.

At these points the explosion is slight, but at the intermediate points it is sudden ; and it attains its greatest violence, and consequent danger, when there is 14 per cent. of gas, or 1 volume of gas to 6 of atmospheric air.

From these tables it is obvious that, in order to form an explosive mixture, with gas as one of the ingredients, it is necessary to add a large quantity of atmospheric air; but there is something more than even this required, inasmuch as gas is only about half the weight of common air, and, if the two substances be placed together in an enclosed vessel or chamber, the gas will rise to the top, and the air will occupy the lower portion in exactly the same way as oil and water, the former of which, on account of its greater lightness, floats above the latter.

In order, then, to make a strong explosive mixture with these ingredients, it is necessary not only to place together

in the same vessel or chamber the proper quantities of gas and air, but also to stir them both well up, and to mix them thoroughly together until they become completely blended into one mass.

This will account for the comparative freedom of great cities from serious losses arising from leakage or other escape of gas. In most of these cases there is a highly inflammable but not explosive substance at the top, a harmless substance at the bottom, and a dangerously explosive mixture at or about the line at which the two meet. When, therefore, a light is applied, it acts on a small quantity of this explosive mixture, which is, as it were, padded in by two highly elastic substances, which act to a certain extent as fenders or buffers to check the impact of the shock on the surrounding walls.

It may be laid down as a rule, not exactly invariable, but quite sufficient for general purposes, that the more heavy a so-called gas explosion is, the more complete is the instantaneous consumption or combustion of the gas employed, and consequently the less danger of fire ensuing; whereas in only light or partial explosions there may be large quantities of pure gas in close proximity to the explosive mixture, and, if this take fire, it burns with great fury, and communicates heat and flame to very considerable distances.

In order to take a familiar instance of what could be done to make a strong explosion, let it be assumed that an order is given to blow up a gas-holder with the enormous, but in the present day not unusual capacity of a million cubic feet, and then consider what it would be necessary to do for the purpose.

In a vessel of that size it would be necessary to have 140,000 cubic feet of gas, and 860,000 cubic feet of air, in order to make the strongest explosion.

When the holder has reached such a height as to contain the exact quantity of gas, it will then be necessary to lift the whole vessel by artificial means, six times that height, and at the same time to make a sufficient opening to admit

the enormous quantity of air above-mentioned, during the operation, as it is not to be supposed that any ordinary power could lift up this vast metal vessel so long as there is a vacuum inside; and, when all this heavy labour has been concluded, there would still be no certainty that the air and gas were blended together so as to form a thoroughly strong explosive mixture. But, on the other hand, assuming that the holder or vessel is already full, it would be necessary to expel or drive out from it no less than 860,000 cubic feet of gas, and to replace that quantity by a corresponding volume of common air; which could be done in this way. Two holes should be cut in the metal vessel, one to admit the air, and the other to allow an exit for the gas. A large steam-pump, such as one of the great London floating machines laid high and dry on the shore so as to pump air only, with 240 horse-power and running at an exceptionally high speed, would take no less than 49 hours to drive in the quantity of air necessary for the supposed purpose.

It is only by making these assumptions, and working them out to their logical conclusions in a plain and practical manner, that the utter absurdity of all such ideas as those occasionally promulgated about blowing up gas-works can be clearly demonstrated.

Two remarkable instances of the absolute safety of gas-holders, under circumstances commonly considered dangerous, must be familiar to all who take an interest in such matters.

The first was at the fire which took place at Sir Charles Price's oil-works at William Street, Whitefriars, in November, 1862. On this occasion the flame was most intense, and ignited several houses which stood at some distance off, and the City Gas Works adjoining became heated to such a degree, that the paint was scorched off the holders, and yet not the smallest explosion took place.

The other was the explosion which occurred at Nine Elms in October, 1865. In this latter case a dangerous mixture was carelessly or accidentally formed in the testing-

house, which stood between the two large holders, and, on the application of a light, it exploded with great violence, blowing the testing-house itself into the air, doing immense injury to the whole neighbourhood for about half a mile in every direction, and smashing in the metal of the two great holders, thereby allowing the gas to escape freely. One of the holders simply emptied itself into the open air, and its contents passed off with no worse effect than making a strong smell. The other, which had a rupture or opening of about 25 square feet, took fire from the retort-house, and burned away with a great blaze and strong heat, but no explosion, and, though a strong force of steam fire-engines was present, it was not necessary to take any steps beyond merely watching until the gas had been almost consumed, and then cooling the holder with water, after which there was no difficulty in extinguishing the flame. In this case there was a combination of everything which is commonly supposed to cause an explosion, but the gas burned away notwithstanding, without doing the smallest damage.

Even in the event of a very rapid and abundant discharge of gas into the open air, very little danger is likely to arise, as the gas would instantly ascend in a vertical direction, as smoke is seen to do, and as a balloon charged with the same material does still more quickly.

As a matter of fact, the gas-works of a city can be as easily blown up as any other places of manufacture; but the best mode of accomplishing this object would be, not by any power supplied through the gas itself, but by gunpowder, nitro-glycerine, dynamite, or some similar substance applied externally, and the immediate effect on the works themselves would be precisely the same as on any other works. There would, of course, be the additional effect of darkening a considerable portion of the town; but this result would be quite as well produced by shutting down the outlet valve of the main-pipe, and so preventing the gas passing.

The supposition that the breaking of a gas main would have the effect of blowing up the gas-works is a complete

mistake, arising from entire ignorance of the whole subject; and it is surprising that, after the many years during which this mode of illuminating has been in general use for public and private purposes all over the world, it should still be necessary to combat this most absurd and obvious error.

With free ventilation into the open air an explosion is impossible; and on this account it is most desirable to place gas-meters outside houses, or, where this is not practicable, to have a flue directly above communicating with the open air, so as to carry off immediately any gas that may escape, before it has accumulated sufficiently to cause danger.

When a gas-pipe has been once filled with gas, it should be kept full; shutting off at the meter is in every case a mistake, and in large buildings an imminent danger, as any forgotten burner out of hundreds may admit sufficient air to cause an explosion.

But mysterious terrors are not altogether of recent date; there were in former days some grand old scares of which tradition gives us highly coloured, not to say poetical, accounts, and of these the history of Greek fire is not among the least.

This substance, it appears, was used as an implement of war, especially at sea; but a slight investigation will suffice to show that, even with the most constant and skilful watching, it must have been almost as dangerous to those who carried it as to the enemy, and that in any case it was, to say the least, a disagreeable and undesirable shipmate.

The two following receipts for making Greek fire are quoted by Ewbank, as taken from one of the old Christian Fathers, Vincentius, a celebrated writer, about A.D. 400 to 450:—

First.—"An equal quantity of pulverised resin, sulphur, and pitch, one-fourth of opoponax and of pigeons' dung well dried, dissolved in turpentine-water, or oil of sulphur; then put into a close and strong glass vessel, and heated

for fifteen days in an oven, after which the whole distilled like spirit of wine, and kept for use."

Second.—"Greek fire consists chiefly of turpentine-water (spirits of turpentine), slowly distilled with turpentine gum."

Either of these compounds was said to ignite by coming in contact with water."

The following account of this substance is taken from Knight's 'Cyclopædia' of thirty years ago:—

"Greek fire was an invention of the Middle Ages, which was often employed in the wars of the Christians and Saracens. This subject has given rise to much inquiry, and has excited considerable discussion, and the obscurity in which it has been enveloped has been greatly increased by the taste which has always existed for anything supposed to be marvellous."

According to Gibbon, the deliverance of Constantinople, in the sieges of the seventh and eighth centuries, may be chiefly ascribed to "the novelty, the terrors, and the real efficacy of the Greek fire."

"The important secret of compounding and directing this artificial flame was imported by Callinicus, a native of Heliopolis, in Syria, who deserted from the service of the Caliph to that of the Emperor."

Gibbon adds, "The historian who presumes to analyse this extraordinary composition should suspect his own ignorance and that of his Byzantine guides, so prone to the marvellous, so careless, and, in this instance, so jealous of the truth." From their obscure and perhaps fallacious hints, it should seem that the principal ingredient of the Greek fire was naphtha or liquid bitumen, a light, tenacious, and inflammable oil, which springs from the earth and catches fire as soon as it comes in contact with the air.

"The naphtha was mingled—I know not by what method or in what proportion—with sulphur, and with the pitch that is extracted from evergreen firs."

One of the properties here stated to belong to naphtha is obviously incorrectly ascribed to it, inasmuch as, if it were

spontaneously inflammable, it could not even be collected. and of course could not be mixed with the other ingredients which are named.

Whatever may have been the precise nature of the mixture, the account of its effect is thus given by Gibbon, evidently exaggerated :—

"From this mixture, which produced a thick smoke, and a loud explosion, proceeded a fierce and obstinate flame, which not only rose in perpendicular ascent, but likewise burned with equal vehemence in descent or lateral progress. Instead of being extinguished, it was nourished and quickened by water. Sand, urine, or vinegar, were the only remedies that could assuage the fury of this powerful agent, which was justly denominated by the Greeks the liquid or maritime fire.

"For the annoyance of the enemy it was employed with equal effect by sea or land, in battles or sieges. It was either poured from the ramparts in large boilers, or launched in red-hot balls of stone and iron, or darted in arrows and javelins, twisted round with flax and tow which had deeply imbibed the inflammable oil. Sometimes it was deposited in fire-ships, and was blown through long tubes of copper planted on the prow of a galley and fancifully shaped into the mouths of savage monsters, that seemed to vomit a stream of liquid and consuming fire."

According to Gibbon, the secret of the Greek fire was confined above four hundred years to the Romans of the East. It was at length either discovered or stolen by the Mohammedans, and in the Holy Wars of Syria and Egypt they retorted an invention contrived against themselves on the heads of the Christians.

The "Feu Gregeois" is thus described by Joinville :—"It came flying through the air like a winged long-tailed dragon, about the thickness of a hogshead, with a report of thunder and the velocity of lightning, and the darkness of the night was dispelled by this deadly illumination."

The use of Greek fire was continued until the middle

of the fourteenth century, when it was superseded by that of gunpowder.

When Yprès was besieged by the Bishop of Norwich in 1383, the garrison defended itself by Greek fire.

A Dr. MacCulloch once read, at the Royal Institution, a paper on the subject of Greek fire, in which he remarks, that very different things were known by the same name, and that he supposes the various projectile means and combustibles employed to have been essentially different.

It is quite plain that these substances could be safely kept only in small quantities, and would be almost as dangerous to the persons using them as to those against whom they are directed.

They are, moreover, evidently much inferior to many well-known chemical compositions of the present time, even in their quality of producing fire. For instance, common phosphorus ignites at a very low temperature; in short, at such a heat as can be produced by holding it in the hands, or by slight friction, or in hot weather, perhaps, by mere exposure to the air. It need, therefore, only be mixed with a little water to make it safe to carry about, and, when the water is poured off, the phosphorus becomes dry and ignites, the time which it takes to ignite being simply dependent on the quantity of water which has to be evaporated or otherwise removed.

One of the best known substances used for the purpose of generating combustion spontaneously, as it is called, is a mixture of common phosphorus with bi-sulphide of carbon or sulpho-carbonic acid.

These may be mixed in any proportions, but the more phosphorus there is the more rapid will be the effect.

It may be in some measure true as a chemical fact that water will not extinguish Greek fire; but this view, if stated in full, would amount to about this, that, if a very large quantity of Greek fire be placed in a strong metal vessel or tank and set fire to, water will not put it out. If, however, such a circumstance were to take place, there would be no particular object in attempting to extinguish the fire; on

the contrary, it should be allowed to burn away in the tank.

The practical view of the question seems to be that Greek fire, or any of the modern chemical compositions which are commonly spoken of under this general name, cannot be safely used except in very small quantities, which consume themselves, so to speak, in a few moments after they become ignited, and which consequently have no more danger in them than a candle, a red-hot poker, a box of lucifer matches, or any other of the means in ordinary use for lighting fires.

In short, it appears that if Greek fire be used in cities, it can only be used as lucifer matches or any of the other similar appliances for lighting fires; that, although it may be superior to these in the estimation of the incendiary, one of whose objects would be to escape detection, it is not in any way different from them, or more dangerous when considered from the citizen's point of view: and finally that, even in the event of fires happening from this cause, the firemen will have to deal, not with Greek fire, but with the ordinary articles of commerce in a state of combustion, exactly as they see them every day and night of their lives.

Some years ago a distinguished actuary made effort to ascertain the value of all the insurable property in London, and after considerable research gave his opinion that at that time one-third of the insurable property was insured.

As the amount insured was known through a Parliamentary return, this gave a basis for calculation to those who chose to adopt it, and, in fact, whether correct or not, it was the only basis known at that time. Since then the duty on fire insurances has been removed, and now the probability is that about half the insurable property is insured; but a very interesting point in connection with this subject is that the official returns clearly indicate that in at least one city of the world the value insured and the rateable value bear a distinct proportion to each other.

The following table shows that for the last ten years the insured property in London has been from twenty-four to

twenty-six times the amount of the rateable value, and taking the previous calculation to be approximately correct, the total value of property may be ascertained by multiplying the rateable value by 50, which for the year 1882 makes it reach the respectable figure of nearly 1400 millions sterling.

Year.	Total Value of Insured Property in the Metropolis.	Total Value of Rateable Property in the Metropolis.	Proportion which Insured Property bears to Rateable Property.
1873	516,970,632	20,549,011	25 times.
1874	540,146,582	20,886,946	26 „
1875	563,572,367	23,111,313	24 „
1876	579,796,226	23,136,819	25 „
1877	603,852,585	23,469,970	26 „
1878	615,697,265	23,960,109	26 „
1879	624,502,135	24,501,410	25 „
1880	657,294,128	27,405,488	24 „
1881	678,160,003	27,386,086	25 „
1882	696,715,141	27,883,078	25 „

The mode of keeping fire records differs a good deal in many parts of the world, and this is much to be regretted, as the value of statistics entirely depends on their having a common basis or general principle ; and an arbitrary classification, however correct, for any one city necessarily involves some liability to error when used for purposes of comparison.

In many cities chimney fires and false alarms are counted as fires when the fire-engines turn out for them ; in others false alarms are eliminated, but chimneys are included ; while in those where true accuracy is studied, all these are entered separately so as to show at a glance chimney fires, false alarms, real fires, and total calls, which latter item includes all the others.

Then with regard to actual fires the classification also differs, some giving large, middling, and small ; others large and small ; and, again, others totally destroyed, seriously damaged, and slightly damaged ; but this last-mentioned

mode is so entirely misleading that it has long since been abandoned almost everywhere, though unfortunately it is still to be found even in a few important cities by those who seek for it.

To give an idea of the way in which it works, it need only be mentioned that the greater number of those shown under the head of total destruction might with more propriety be entered as very slight damages. For instance, a fire occurs in a dock with warehouses containing property worth ten or twelve millions sterling, and results in the total destruction of a watchman's sentry-box valued at five pounds. It was actually a series of incidents such as this, which led to the abandonment of the old plan of having a separate entry for property totally destroyed.

But the difficulty of making safe calculations does not end here, some of the records being of such a kind as to require laborious investigation before the facts can be ascertained. Taking, for example, the latest published New York record, that of 1882, it appears at first sight that there were 2269 alarms, but on examination it is found mentioned further on that of these 2001 were fires. On further investigation, however, it appears that the actual fires involving loss of money were only 1273, and the remainder must therefore have been false or chimney alarms; but this difficulty is not confined to the New York statistics, which are kept as strictly as those of many other cities.

In the following table all the figures have been taken from authentic official sources, and in every column except the last may be assumed to be absolutely correct; but in preparing that which gives the number of fires it has been necessary to study the arbitrary classifications adopted in the various cities, and to pick out the information from several parts of the published reports and records. This has been done with great care and an earnest endeavour for accuracy; but the result is not put forward as being anything more than approximately correct.

Perhaps the principal interest in this table will be found

in a study of the amounts which the several cities choose to spend in protecting themselves from the ravages of fire.

TABLE showing the COST of the MAINTENANCE of FIRE BRIGADES, and other particulars concerning TEN of the LARGE CITIES of the WORLD, for the Year 1882.

CITY.	Area in Square Miles.	Estimated Population.	Cost of Maintenance of Fire Brigade for 1882.			Total Number of Firemen.	Number of Fires, exclusive of False and Chimney alarms.
			£	s.	d.		
Berlin ..	29	1,123,000	69,200	0	0	765	543
Boston ..	37	400,000	96,191	0	0	663	349
Brooklyn	22	650,000	72,701	0	0	256	151
Chicago	36	503,300	109,004	0	0	397	919
Cincinnati	25	269,000	41,330	0	0	172	280
London	121	3,816,843	103,458	0	0	576	1,926
Montreal	6	140,747	11,319	0	0	68	226
New York	42	1,206,299	335,816	0	0	826	1,273
Paris ..	30	2,269,023	80,624	0	0	1,742	982
Vienna ..	..	1,103,860	20,000	0	0	180	358

No principle generally applicable has yet been laid down as to the amount which a city ought to spend on its protection from fire ; but it must suggest strange thoughts to find the extraordinary difference actually existing between the sums spent in various parts of the world.

Taking for example two capitals, London and New York—one with a population of more than three and three-quarter millions, the other with a population of less than one million and a quarter—the first containing property estimated to be worth about fourteen hundred millions sterling, the other, as nearly as can be calculated, about one-eighth of that value ; the first spending £103,000 a year on its protection from fire, the second, £335,000 ; taking all this into consideration, who shall say which is the wiser of the two?

The great James Nasmyth, who has revolutionised the whole course of dealing with metals by his wonderful invention of the steam-hammer, tells his friends that all his

success has been due to the application of common sense to the use of materials, and that he owes a great portion of it to a lesson he got, when he was commencing life, to the effect that no man has a right to call himself a mechanic who cannot cut a plank with a gimlet and bore a hole with a saw. To the superficial this may sound as a pleasantry or a paradox, but on examination what a wealth of wisdom there is in it. How entirely it places a man above his tools, and how right it is in doing so. To James Nasmyth, and all such as he—the men who by force of genius have unconsciously done great good in their generation—the accidental dropping of these little pearls of wisdom counts as nothing ; they do it because they cannot help it ; but to those who humbly follow in their track, these gems of thought, little known or understood by the world at large, are full of vigorous beauty and enduring usefulness.

When a great Frenchman, describing all the essential qualifications of a diplomatist, wound up with "*surtout point de zèle*," he unintentionally gave to the world a *mot*, which may be used with advantage in every profession for all time ; and so it is with our king of mechanicians, whose pleasant paradox, rightly read, is found to open up a world of useful thought to many beyond the chosen few for whom it was intended.

A man may not be able to do any great act without some appliances, but he is the best man who works with the fewest and the simplest, and this is another test to which firemen may well be subjected.

All over the continent of Europe the men are trained very carefully and methodically, though not always practically, and great reliance is justly placed on them ; but the appliances are of a lightness and smallness which for such a business may be designated frivolous. In America, on the contrary, the men have no real training at all ; the chief does not personally take charge of their instruction and teach them everything which they ought to know, but the appliances are in their way magnificent, though far too cumbrous.

Thus it will be seen that on the continent of Europe the office of the men is magnified, and that of the appliances underrated, while in America a practice diametrically opposite prevails.

Here in England—at least in many important cities, and especially in the capital—every effort has been made to give an appropriate importance to each of the component parts of a fire brigade, and the result is that the men are thoroughly trained to the appliances, and the appliances are suited to the work and to the men.

All these matters are brought about by the habits and circumstances of the several localities. In Europe large numbers of men are, for many reasons unnecessary to mention, kept always under discipline, and it is an easy matter to use a portion of them for any special purpose, such as that in question, without wholly withdrawing them from the force of which they always continue to form an effective part. These countries are not rich, and all their resources seem to be so completely exhausted in keeping up their vast military systems that there is no money left for anything else. The special training costs nothing, and consequently there is plenty of it; and it is as good as any system laid down in books, and intended for general use, can be expected to be.

But as to machinery and appliances, there seems to be in most of the cities a very inadequate provision; and where this state of things exists, want of funds is invariably stated as the cause. In all these places the discipline is perfect of its kind, but it is merely military, and for the most part consists of blind obedience to orders, which is hardly enough for firemen.

It is right to mention that a few large cities form a notable exception to this humiliating condition of things, and certainly show a tendency to rise above the dead level; but the tendency is not pronounced or vigorous, and the rise, though undoubted, rather encourages hope than indicates completion.

In America the discipline of the old countries is unknown,

and the power greater than discipline, that of knowledge and experience, is not allowed to grow, and therefore real training is impossible; but many of the men are of a splendid type, and, if they only got the chance, would probably be unsurpassed. There is very little, however, which individuals can do in dealing with large fires; it is the combination which is needed, and this can only be produced by chiefs who have acquired their experience by real labour and study, and can impart it with freedom and certainty to those who serve with them, so as to induce confidence, and thus lead on to real discipline, which is by no means the same as that already mentioned in connection with the European forces.

Why America, which is so wise in many things, so great in all, should subject the chiefs of the fire departments to annual or other frequent elections, and so deprive them of the best means of making themselves useful, has never been satisfactorily explained. But so it is. Even men who have been chiefs for several years, and such men are to be found, have had to undergo periodical elections during their service, and thus have had their attention distracted from their proper work, and their authority undermined by the incidents and occurrences inseparable from such proceedings. It is, moreover, openly stated by persons of apparent authority that in many cases the Commissioners purchase appliances without any application from the working chief, and even without his knowledge, and that the first he hears of them is when they are handed over to him for the use of his department; but this class of statement must always be accepted with distrust in America, where political feeling runs high, and frequent elections lead to a freedom of expression sometimes amounting to exaggeration. It may, however, with some confidence be said that the general course of proceedings in America makes the position of a chief precarious, and to that extent weaker than it ought to be for such a work; but as to the machinery and appliances, there appears to be no restriction at all.

The expenditure is lavish in the extreme, and the fire departments are crowded and loaded with every implement that the ingenuity of inventors has devised to relieve firemen from risk and labour.

That much has been successfully done in this way cannot be denied ; but, in such a case, it must always be a question how far it is safe to go in substituting machinery for men, and even the experience of America, however satisfactory, has not hitherto been so conspicuously manifest as to undermine the authority of our apostle of the steam-hammer. Indeed, it is not difficult to foresee that their buildings, which every year are growing larger and larger, until they have already in a few instances almost attained the magnitude of those in Europe, will shortly make the use of heavy appliances impossible, and when this happens they will be compelled to go in for strength and lightness.

But it is not in America only that firemen must look forward thoughtfully and watchfully. Here in England the magnitude of the risks and their proximity to each other are in many cases formidable, and there is no present reason to suppose that this state of things has reached its worst ; on the contrary, every succeeding year appears to add a few additional causes of anxiety, and to show distinctly that, if ever the appliances become unsuitable for the work or insufficient in quantity, or if ever the firemen become careless, or unskilful, or wanting in energy, fearful disasters may be expected to ensue.

As already stated, much depends on architects, merchants, manufacturers, and others, who (quite rightly) will not stay their progress for any special class of men, and least of all for their own paid servants whom they employ for the purpose of protecting them ; but much also depends on these paid servants, whose duty it is to watch the present and anticipate the future, never to be taken by surprise, but to be always ready to devise impromptu measures for meeting every emergency which may arise, however formidable or sudden.

The course of events is rapid in our present wondrous

days, and sometimes firemen may be hard set to keep pace with it; but if only they work with energy and skill and that unity of purpose which results from true discipline as distinguished from the imperfect mechanical discipline already indicated, and if they are known to shrink from no toil or risk in the performance of their duty, the great national waste through losses by fire may be kept within reasonable limits, and the public may continue the encouraging confidence and kindly appreciation which they have hitherto so generously accorded to the humble but devoted services of their fire brigades.

LEGAL OBLIGATIONS

IN RELATION TO THE

DWELLINGS OF THE POOR.

BY

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WITH A PREFACE BY

ARTHUR COHEN, ESQUIRE, M.P.,

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PREFACE.

I HAVE been asked to write a few words by way of preface to a book, the object of which is to state the existing law relating to the dwellings of the poor. I think my friend Mr. Duff has succeeded in accomplishing a task which is not without difficulties, in giving an exposition of that law which is at once clear, accurate and popular. It seems to me to suggest a few obvious observations—observations accentuated by some experience among the poorest houses of the borough which I represent in Parliament.

In the first place it proves that, so far as the structure and condition of the houses of our poor are concerned, the evils, which have been described in language so powerful and graphic, and which undoubtedly exist, might all be removed by the exercise of legislative provisions which at this moment are contained in the statute book. Many of these evils and defects have been allowed to continue because the local authorities do not perform their statutory obligations; almost all of them exist because the local authorities do not exercise the powers which they are authorised to put in force. Indeed, it is extremely difficult, if it is possible, to detect a single blot in the social condition—so far as their dwellings are concerned—of our poor, for which there does not now exist a statutory remedy.

There are formidable obstacles, no doubt, which hinder the exercise of the powers given by statute. Their exercise would require a large expenditure of money on the part of

the local authorities, and these bodies are reluctant to impose the burden on the ratepayers. Landlords, who in many important cases make default in performing their obligations, exercise an unhealthy influence; and the inspectors, whose duty it is to inform the authorities of the evils which exist in their district, are too dependent upon the countenance of those authorities. Above all, it should be well borne in mind that the local authorities represent only separate districts; that improvement in one district is apt to mean deterioration in another, inasmuch as it occasions migration from one locality to another. This seems to point to the necessity of creating some central authority (as regards the Metropolis) which should organise and superintend improvements, with power to indicate, in some systematic method, the course which should be adopted for effecting them, and at the same time equitably to distribute the burden of paying for them. It seems to me that this view cannot be too strongly insisted upon; an area is cleared in the City, for example; good houses are built in the place of dilapidated dwellings; the value of land is much increased; but the consequence is, that the poor are driven out from the City into other parts of London, and that the evils which are removed from one district are reproduced in another. It is true that there are enactments intended to provide for the construction of dwellings in the place of those which are demolished, but experience has proved that those enactments are inadequate for the objects which they propose to effect.

There is also one important fact to which I desire very earnestly to direct attention. I have found, in visiting the dwellings of the poorest people, that there are a great many who have lived for several years in the same rooms, who often gain their livelihood by carrying on some small trade or business in them, who have gained credit among the tradespeople in the neighbourhood, and who thus have

acquired what may fairly be considered as a goodwill in the house they occupy. If they are suddenly deprived of their dwellings, they are deprived of their means of livelihood; and many a so-called improvement has driven honest and hard-working families into the workhouse. In attempting to effect improvements, it is therefore most important not to work injustice. When the ruinous and dilapidated building has been removed, and in its place a sanitary and well-constructed house has been erected, then, to use the well-known phrase of Bastiat, what is seen is the commodious dwelling, what is not seen is the misery of those who have been driven out into still more wretched habitations, or into the workhouse.

I wish to confine my observations to the Metropolis, as my experience has been limited to it. The reasons why poor people crowd from the country to this city depend partly upon causes connected with the laws relating to land, and partly upon other questions which it would not be useful to discuss on the present occasion; but, as regards the Metropolis itself, the few observations I have made seem to lead to the following conclusions :—

1. Some central authority ought to be established whose duty it should be to secure the due performance by the several local authorities of the duties imposed on them by statute, and the due exercise of the powers with which the Legislature has entrusted them, and to distribute equitably over the whole Metropolis the burden of the expenditure which would be the consequence of it. It should be the duty, also, of this central authority carefully to provide that, at the same time as areas were being cleared by the removal of insanitary houses, proper dwellings should be constructed for the accommodation of the poor thereby necessarily dislodged.

2. The inspectors whose duty it is to report to the local authorities should not be dependent on them. At the

present moment a vast deal of work which ought to be done by the inspectors and local authorities, and which ought be done systematically and methodically, is done by volunteers. There is ample scope for the exercise of wholesome and beneficial influence by men and women who take an active interest in the improvement of the condition of the poor; but it is because the inspectors and local authorities do not perform their duties that a great deal of power is wasted. A great many of the existing evils are due to the poor themselves, or to causes which can only be removed or alleviated by charity; in such cases the efforts of volunteers are invaluable, and are the more appreciated because gratuitous. But work which ought to be done systematically and methodically ought not to be precarious, and should be done as the Legislature intended, namely, by the inspectors and local authorities under the existing provision of the law.

3. The case of common lodging-houses has proved that most useful work can be done by official supervision in conjunction with judicious regulations; and it is no exaggeration to say that whereas many years ago the common lodging-houses were the source of physical and moral disease until disciplined and organised by bye-laws, they may now, as regards decency, cleanliness, and health, be considered model lodging-houses. The Local Government Board has recently given the local authorities of the Metropolis power to make bye-laws for the regulation of lodging-houses which do not fall within the category of common lodging houses, and there is therefore no reason why what is said of common lodging-houses should not be now said truly of others. So far as law can prevent it, immorality, overcrowding, disease, should now be prevented. It should be the duty of a central authority to see that bye-laws are judiciously framed and energetically enforced, for bye-laws are better not made than made and disregarded. If this

course were adopted, it might and would, no doubt, impose at first considerable expenditure upon particular districts; but, as I have said before, this should be distributed equitably over the whole metropolis; and there is no doubt that ultimately it would prove productive no less of economy to the whole city than of real benefit and advantage to the poor.

There are, no doubt, evils which no laws relating to the habitations of the poor can cure; none the less, I hope and believe that this little book will do something to convince the public that it is not impossible, that even it is not difficult, for the Legislature to provide means to secure the due exercise of those powers which it has already called into existence, and which, if duly exercised, are almost co-extensive with the evils which result from the deplorable condition of the dwellings in which so many of our poor live.

ARTHUR COHEN.

CONTENTS.

LEGAL OBLIGATIONS

IN RELATION TO

THE DWELLINGS OF THE POOR.

I. INTRODUCTION.

IN the course of the debate which followed the Marquis of Salisbury's motion for the appointment of a Commission to inquire into the condition of the houses of the working classes, on the 23rd of February, 1884, it was stated by the Earl of Shaftesbury "that there was no necessity for fresh legislation: there were Acts of Parliament enough, which only wanted to be consolidated and put consistently into practice." The belief is now gradually gaining ground that the law, as it exists at present, is fully competent to deal efficiently with a large number, at least, of the evils which characterise the homes of the poorest classes in populous towns, and that what is really required is rather the recognition and enforcement of existing powers than the creation of fresh ones. It is the object of the following pages to examine what the provisions of those Acts of Parliament are, and how far they extend; what evils they are competent to check, by what means they attain their purpose, and within whose power or duty it is to enforce them—in fact, to take a survey of the existing law. This law is contained in a number of statutes, ranging in date from 1848 to 1882. Some of them are only "permissive" or "enabling" statutes, imposing no duties at all, but simply

giving certain powers to those who elect to come forward and claim them. Such create, strictly speaking, no legal obligations; their language is *may*, not *must;* nevertheless they form no inconsiderable portion of the materials which bear on the present question. For example, in the metropolis the vestries of parishes *may* (but *need* not) make bye-laws to secure the maintenance of decency and order in houses occupied by members of more than one family. Others are of general application, and are not in terms confined to the dwellings of the poorer classes, although, in fact, their operation is almost entirely limited to them; thus no person, whosoever he may be, or wheresoever he may dwell, is permitted to allow his house to be in a state dangerous to the health of his neighbour; while others have been expressly passed in the interest of the homes of the poor, and are framed for the purpose of providing them healthy and wholesome dwellings. Collectively, these statutes will be found to have two main objects.

1. Immediate prevention of existing evil.
2. Future improvement.

And it is practically true to say that those which provide for the former are almost invariably compulsory, while the obligation of those which deal with the latter, as a rule, is optional.

Upon whom do these legal obligations rest? By the general law of the land, any person who does an act endangering the health of his neighbour, without his neighbour's express consent, violates a legal obligation. It is doubtful, indeed, how far such consent, if obtained, will excuse him in the eye of the law; certainly in some cases it will not, for there are some rights—as, for instance, that of life—which no person is permitted to waive. Whosoever he may be, landlord, tenant, or lodger, who does an act, or permits the existence of a state of things which imperils the safety of his neighbour, infringes his neighbour's right, and thereby of necessity evades his legal duty. Whether his neighbour will call him to account is another matter. None the less

has he done a wrong. But suppose a person voluntarily puts himself in a position where the evil affects him—suppose, for example, a person knowing a house to be unhealthy agrees to occupy it. It is said, truly enough, that no man suffers wrong except against his will, and it may be urged, not without plausibility, that the willing tenant is the author of his own misfortune. So, in a sense, he is, and the complaint cannot come from him. But has the landlord failed in a public duty the less, or is the State therefore less entitled to intervene in the interests of the public health? To answer this question one has only to turn to the statute book to see that there are legal obligations, as it were, within legal obligations; that there are certain persons whose statutory duty it is to see that private individuals do not, so far as public health is concerned, fall short of their duty to their fellow-men, and upon whom a legal obligation is cast of forcing them to perform it.

It is advantageous, for many reasons, to have clearly in mind at the outset, in general terms, the evils with which the existing law has professed to deal. First in immediate importance comes the existence and occupation of houses in such a state of disrepair and dilapidation as directly to imperil the health of anybody dwelling in or near them, premises, to use the words of the statute, "dangerous to health so as to be unfit for human habitation." There is no need of fresh legislation to stop *that;* ample powers are already in existence, powers efficient not to stop it merely, but to cause the houses to be demolished and rebuilt. Second, of equal importance, but far more difficult to cope with—overcrowding. It is upon this head that the Marquis of Salisbury laid particular stress. "So long as you confine your attention to sanitary legislation, and do not bear in mind this overcrowding, which is the dominant evil, your sanitary legislation will be a failure; the local authorities, press them as you may, will not carry out your enactments in that respect. That is really the most important matter upon which the investigation ought to occupy itself, for this overcrowding, unless you can meet it, will neutralize

all your efforts, and you cannot meet it unless you possess sufficient knowledge of the precise character of the evil. What is wanted is to know what are the localities in which overcrowding exists, and how many of those who are thus crowded together are forced to dwell in those localities." It is possible that when such knowledge has been acquired, new and practical legislation may be framed to utilize it; at present, overcrowding has been ineffectually provided for by law for the last fifteen years; ineffectually, not because adequate means have not been created, not because powers sufficient have not been conferred, but simply and undisguisedly because they have not been enforced. Third, bad drains, bad ventilation, anything making premises dangerous to the health of their occupants or neighbours. Better provisions cannot exist to stop them than exist already. And not only *can* these evils be stopped; the law has created certain bodies for the very purpose—sanitary policemen, as it were—and has imposed upon them the absolute duty of discovering and stopping them. Wherever a house is found so dilapidated or unhealthy as to be unfit for human occupation, there is ample power to have it closed, demolished, or rebuilt; and if, as in most of our great towns, years of apathy and neglect have allowed the poorest localities to fall into such a state that piecemeal improvement is waste of labour—if they have developed into unhealthy districts, infested by disease or sickness attributable to bad building, want of air or light, and proper sewage—all this has been already recognised and treated by the legislature; provisions already exist under which not only single houses, but even whole areas, may be demolished, and converted into sites for healthy and habitable structures.

The right of the State to interfere, and impose on the owner of premises the duty of keeping them in a proper condition, is assumed throughout all the legislation which bears upon the demolition and reconstruction of unhealthy houses. This duty has nothing to do with the relation of landlord to his tenant, of owner to the person

occupying his house, for that is a matter of contract, depending entirely upon what agreement the parties make between themselves. If a landlord likes to let his houses fall into ruin, and a tenant chooses to rent them in that condition, the latter has no just ground of complaint as tenant against his landlord, since he has voluntarily assumed the position of which he now complains. The interference of the State is based upon far broader grounds; it rests partly on the ground that all property is held by the owner subject to certain rights on the part of his neighbours, that it is a man's duty so to deal with his property, as not to cause injury to another—a doctrine formulated in the monkish Latin of our early law in the maxim, *Sic utere tuo ut alienum non lædas*, and partly upon the fundamental truth that to promote the health and happiness of its subjects is the principal end of all government. A person who uses his property in such a way as wrongfully to annoy or injure his neighbours, creates, in technical language, a nuisance, and by the common law subjects himself to an action at the suit of any one specially injured, or to a criminal proceeding at the suit of the Crown, as representative of the people as a whole. But when the public health of the country began to become a matter of public concern, it was felt that it was not sufficient to leave to individual energy the redress of grievances which might seriously affect a considerable number of the community; it was thought, moreover, that certain grave public evils might not possibly fall within the common law definition, therefore certain states of circumstances were declared by statute to be nuisances, and the duty of putting a stop to them was imposed upon certain authorities having power in the district where they should be found to exist. Among them are the two evils first enumerated, viz., unhealthy houses and overcrowded dwellings. The legal obligation clearly rests, in the first instance, upon the person who has permitted the house to be unhealthy, or the dwelling to be overcrowded; the very existence of the evil, however, implies his breach of

duty. It rests in the second instance upon the persons who, by Act of Parliament, are bound to put a stop to it. But in either case it is imperative.

It has been said that where the law deals with improvement it is permissive. A man must so use his property as not to injure his neighbour's rights, but no man is bound to use it so as to benefit him. The fact that the demolition of my house will benefit the district, imposes no duty on me to demolish it; therefore the law cannot oblige me to take it down. It may well be that the importance of its destruction is great enough to justify the state interfering to compel me to allow it to be destroyed, and to accept compensation in lieu of it; my legal obligation, in that case, is at most to allow it to be demolished when I have been paid its value; and if the State allows the neighbours to force me to sell it to them, it imposes on them no legal duty though it confers upon them powers. This is how the law stands when it deals with reform as distinct from remedy; it is enabling, not compulsory.

That there does exist among the poorest classes squalor and disease and misery, which it is almost as impossible to describe as it is to exaggerate, is a fact which has now full possession of the public mind; and it is not unfairly attributed, at least in part, to ill-arranged, overcrowded, insanitary houses, lacking the conditions under which even the most ordinary decencies of life can be observed, and which are unfortunately a recognised feature of our great towns. At least in part—for the housing of the poor is only a part of a much larger problem. It is evident that there must be a moral as well as a material side to the question, and that sanitary laws are competent only to deal with the latter. Given a bad house filled with degraded occupants, is it fair to attribute the condition of the inmates entirely to their domestic surroundings, or would a good house render them virtuous and happy? It is at any rate unquestionable that a good house would be a step in the right direction, and that it is a step which has yet to be taken.

Whether the admitted degradation of a large part of the lower classes is a necessary concomitant of the present condition of society is the real question, and it is one which demands a serious answer. A man is very much what his home makes him, and if there is any truth in the old adage that the child is father to the man, childhood spent in vice and filth and crime is hardly likely to develop into industrious, respectable, and healthy manhood. If these things were inevitable or irreparable there would be no more to be said; but it is conceded on all hands that amelioration is as possible as necessary. The difficulty only arises as to the means.

What means does the existing legislation afford? In other words:—

1. Who are the persons entrusted with the carrying out of the law?

2. What are their powers?

3. Is the enforcing of these powers left entirely to their discretion?

4. Are these powers comprehensive enough to embrace all the evils complained of?

The responsibility in the first instance is almost uniformly imposed upon certain authorities called "local authorities" (see p. 642), who are charged with the management of the district where the evil lies. They are invested, for this purpose, with certain duties which they are bound to discharge, and with certain powers which they may enforce or not at their discretion. It will be a matter of some surprise to many, to learn how extensive their functions are, and what a change might be effected if they were actively invoked. As to their duties, speaking in the most general terms, they are under obligation to know of the existence, within their district, of any premises in a state injurious to health, any foul cesspool, privy, or closet, any house overcrowded with inhabitants, anything, in short, which the law regards as a nuisance, and to call upon the person causing or permitting it at once to have it stopped. It is their duty to see that he does so, or to do it at his

charges. It is their duty, should a house be in such a state as to be unfit for human habitation, to order the owner to make it habitable or pull it down. It is their duty to regulate by bye-laws all "common lodging-houses" (see p. 663) within their district, and to see that order and decency are maintained therein. Then as to their powers. First, they have various powers to punish persons causing nuisances or owning unhealthy houses; these are auxiliary to the duties previously noticed; they have power to order that all new buildings shall be constructed in such a manner as not to reproduce in the future the disgraceful past; they have power to make bye-laws to regulate all houses occupied by members of more than one family, and to see that they are kept healthy and pure, to secure the due separation of the sexes, and to limit the number of occupants. They have power to build lodging-houses for the labouring classes; they have power to pull down any building which makes another unhealthy or noxious; they have power to demolish and reconstruct whole areas of pestilential and unwholesome dwellings. These powers are given to enable them more effectually to attend to the health of the district, but they are not legally obliged to make use of them; their duties, on the other hand, they are legally obliged to perform, though the obligation has seemingly pressed very lightly in the past.

It may seem difficult to see how, if these provisions were put in force energetically and impartially, such evils as overcrowding, and such disease and misery as bad drainage and ventilation produce, could have place in our towns. Legislation can do very little more than it has done already. Overcrowding is emphatically declared a nuisance in the plainest terms, and if brought to the knowledge of the authority, either by its medical officer, or by any other person, throws upon it the serious responsibility of allowing it to continue, in dereliction of their duty. The same with all other nuisances. Practical difficulties must, of course, to a very material extent, interfere with the application of the law—obviously, for instance, the closing of a house

unfit for habitation, tends immediately to quarter its inhabitants upon a district probably already short of proper accommodation. Indeed, in some such cases, there may be insuperable obstacles to strictly enforcing it. We are not, however, now concerned with reasons why the law has failed; our object is simply to observe the extent of its provisions; and it is surmised that these will appear, upon closer examination, so wide as to leave far less necessity for fresh legislation than is popularly supposed.

The Acts of Parliament relating to the dwellings of the poor are generally known under four heads.

1. The Acts regarding the removal and prevention of nuisances (38 & 39 Vict. c. 55; 18 & 19 Vict. c. 121; 23 & 24 Vict. c. 77; 29 & 30 Vict. c. 90; 37 & 38 Vict. c. 89), the Public Health and Sanitary Acts.
2. The Labourers' and Artisans' Lodging Houses Acts (14 & 15 Vict. c. 34; 29 Vict. c. 28; 30 Vict. c. 28).
3. The Artisans Dwellings Acts (Mr. Torrens's Acts, 31 & 32 Vict. c. 130; 42 & 43 Vict. c. 64; 45 & 46 Vict. c. 59, Part II.).
4. The Artisans' and Labourers' Dwellings Improvement Acts (Sir Richard Cross's Acts, 38 & 39 Vict. c. 36; 42 & 43 Vict. c. 63; 45 & 46 Vict. c. 54, Part I.).

And it will be convenient in considering the subject to follow this classification, pausing on the threshold to glance briefly at the law in outline, before proceeding to fill in the picture.

1. The Acts which deal with nuisances define them, and make it the duty of a local authority (see p.642), to ascertain what nuisances exist within the district which is entrusted to their supervision. They provide machinery by which the person responsible for the state of the premises must be ordered to provide sufficient drainage and ventilation, to make them safe and habitable, to pave, whitewash, disinfect, or purify, any premises belonging to him which are a nuisance, or injurious to health. Indeed, an order may be made, and should be made, closing any house unfit for human habitation, and prohibiting its use for that purpose

until rendered habitable. Should the person so ordered make default in taking steps to "abate" or put an end to, the nuisance, the local authority may itself do so, and may recover the expense from him. A house inhabited by more persons than it will safely hold, having regard to the health of its inmates, whether or not they are members of the same family, is a nuisance, and the person permitting it must be called upon to abate it. In the metropolis, if the house is overcrowded (and if the inhabitants are more than one family), the person responsible for it may be fined; and as a further punishment the house may be closed by order of justices if this occur twice in a period of three months. So, in places other than the metropolis, the house under similar circumstances may be closed; and though no provision is directly made for fining the person who is to blame for the overcrowding, there is little doubt he can be mulcted of £5 under another section of the Act. In one word, the sole object of these Acts is to make people who have done mischief undo it, and to insist on the due performance of the duty which every man, whether owner or occupier of property, owes to his fellow-men.

2. The Labouring Classes Lodging-house Acts contemplate improvement, and are, therefore, permissive merely. They embody a scheme which provides means whereby districts or parishes with a population of over a certain number, or two parishes combining to make up the required number, *may* provide lodging-houses for the poorer classes. They may buy or rent land or premises, build, furnish, and fit up lodging-houses, and then regulate them by bye-laws specially passed for the purpose.

3. The Artisans' Dwellings Acts (Torrens's Acts) are expressly passed, as their name implies, in the interest of working men and their families, and are intended to secure the improvement or demolition of houses "in a state dangerous to health so as to be unfit for human habitation," as well as to give the local authority power to remove buildings not in themselves uninhabitable, but which tend to make others so, or to prevent their being put into a

sanitary and habitable condition. They are partly imperative, partly permissive. Under the first of these Acts (now amended) the owner could be called upon to repair or demolish the unsanitary premises, and had no option but to do it, although in certain cases he might receive compensation. Under the amending Act, however, he can call upon the authority to buy the buildings, and so throw the responsibility and expense upon them. The expense has, under the present system, uniformly to be borne by the district in which the evil lies. As it is clear that the districts which require improvements of this kind most are least likely to be able to pay for them, this cannot fail to have considerable weight with the local authority in influencing their decision as to whether to give the required notice or no. Whereas, as most of the conditions under which an owner can be called upon to repair or demolish under these Acts, are exactly those which are defined as nuisances under the Acts relating to nuisances, by proceedings under the latter Acts he might be compelled to abate the nuisance at his own expense, and it may be, instead of receiving compensation, be subjected to a fine. At the same time it must be remembered that the result of proceeding under this Act is either reconstruction of suitable dwellings for the labouring classes, or practical and permanent improvement of the district, while the mere abatement of a nuisance, although more economical, has no such beneficial effect.

4. The Artisans' and Labourers' Dwellings Improvement Acts (Sir Richard Cross's Acts) contemplate improvements on a much larger scale, though for reasons of expense and otherwise, no imperative duty is imposed to carry them out. They involve what only considerations of great public convenience can justify—the taking of lands without the consent of the owner ; and empower local authorities, in cases where densely crowded, ill-ventilated, ill-drained houses are built thick together, and where the improvement of a single house, or by a single owner, would be inadequate, to frame a scheme for the demolition of the

whole unhealthy area, and for the systematic reconstruction thereupon of healthy and well regulated homes. These Acts only apply to districts with over twenty-five thousand inhabitants according to the last census, which means eighty-seven towns in England and Wales, and eight in Scotland.*

5. Included in the Acts which deal with the removal and prevention of nuisances are important provisions relating to the survey and discipline of lodging-houses, to the terms on which cellars may be occupied as dwellings, and to the requirements which future buildings, in the district over which the local authority has jurisdiction, may be called upon to fulfil.

The foregoing abstract of the Acts creating and regulating obligations which have regard to the dwellings of the poor will serve as a convenient introduction to a more detailed examination of the various groups of statutes. In dealing with them it has been attempted, as far as possible, to use popular rather than legal language, and to disembarrass the subject of technicalities which are of no interest to lay readers; even then, much must remain of the dry detail, which is inseparable from practical law; but which those who desire to examine the question in its legal bearings must be content to master.

II. NUISANCES.

For the purpose of supervision in the interests of the public health, England, with the exception of the metropolis, is divided into districts which are called urban or rural sanitary districts. They are self-governed, being placed under the control of an elective local authority, called the urban or rural sanitary authority, which is subject to the general superintendence of a department of the Central Government, the Local Government Board.

The distinction between urban and rural sanitary districts

* The Act which applies to Scotland is 38 & 39 Vict. c. 49.

is based upon their population, rural districts being co-terminous with the poor law unions, and governed by their guardians, while urban districts have been created whenever the number of inhabitants within a certain area has become so great as to demand or justify a separate administration. Urban districts are of three kinds.

1. Boroughs.
2. Districts subject to the jurisdiction of a local board, and called Local Government Districts.
3. Districts subject to the jurisdiction of any persons invested by a local act of Parliament with the power of town government and rating. These persons are called Improvement Commissioners, and the district an Improvement District.

All places not falling within an urban, must be comprehended in a rural district. The following passage from a recent book on local government* shows how irregular and unsystematic the distribution may be. "Take Kingston union as an example. It contains one municipal borough, one Improvement Act District, and six Local Board Districts dotted about in various parts of its area. Every part of the union that is not included in one of the urban districts is under the sanitary jurisdiction of the guardians. Thus every house is under either an urban or a rural sanitary authority. There is no connection between the boundaries of an urban sanitary district and parish boundaries, or any other area of local government."

The Metropolis means the City of London and its liberties, and the large number of places and parishes circumjacent which are subjected to the jurisdiction of the Metropolitan Board of Works. The internal arrangement of the Metropolis depends, except in some small particulars, upon Acts of Parliament different from those which regulate the rest of England.

The local authorities in urban sanitary districts are—

(1) In boroughs, the Mayor, Aldermen and Burgesses acting by the Council.

* 'Local Government.' By M. D. Chalmers. 1883.

(2) In a local government district, the local board.

(3) In an improvement district, the Improvement Commissioners.

In rural districts, the local authorities are the guardians of the union: they are called indifferently throughout, the local or sanitary authorities.

In the City of London, the authority is the Commissioners of Sewers: in the rest of the Metropolis, the several vestries and district boards, and they are styled the "Nuisance Authorities."

Every district in England, as well as the City of London and the Metropolis, is bound to employ a medical officer of health and an inspector of nuisances, who are appointed by, and the servants of, the local authority. It has been recently suggested, with much apparent reason, that the duty of these officers would be more efficiently performed if they were made independent of the local authority, and responsible to some central authority not immediately connected with their districts, and removed from the possible influence of the landlords of the premises which it is their duty to inspect. Their duties are defined by Act of Parliament. The medical officer of health, in the Metropolis, is to be a person of skill and experience to inspect and report periodically upon the sanitary condition of the parish or district, to ascertain the existence of diseases, to point out the existence of any nuisance, or other local causes likely to originate or maintain diseases, or injuriously affect the health of the inhabitants. The duty of the inspector of nuisances is, among other things, to "report the existence of nuisances, and to take cognisance of any complaint of nuisance made by any inhabitant." In urban and rural districts the local authorities are simply ordered to appoint fit and proper persons to be medical officer of health and inspector of nuisances respectively: and it is evident that fit and proper persons implies persons adequate in number as well as competent in experience to discharge the duties of the post.

The whole of the country is thus mapped out into dis-

tricts, the health and sanitary condition of which are entrusted to local authorities therein: these local authorities are required to appoint certain officers of health, and it is these officers' duty to inform themselves of the sanitary condition of their districts, and to report upon them to the local authority if defective. Such are the persons upon whom a public duty is imperatively cast: if therefore the state of things which is alleged to exist in our towns is true, there is no escape from the conclusion, either that sufficient fit and proper persons are not appointed by the local authority, or that these officers leave their duty undone.

The statute which governs all the districts of England, except the City and the Metropolis, is called the Public Health Act, 1875. The Metropolis is regulated by a series of independent statutes, the provisions, however, of which, so far as the present subject is concerned, are almost identical with those contained in the principal Act.

A nuisance is defined "for the purposes of these Acts,"* as—

1. "Any premises in such a state as to be a nuisance or injurious to health."
2. "Any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain or ashpit, so foul or in such a state as to be a nuisance or injurious to health."
3. "Any animal so kept as to be a nuisance or injurious to health."
4. "Any accumulation or deposit which is a nuisance or injurious to health. (As regards, however, any accumulation or deposit necessarily caused by a person's business, no penalty is to be imposed if it

* A Nuisance at Common Law signifies "anything that worketh hurt, inconvenience or damage. And a nuisance is of two kinds: such as is public or common, which affects the public, and is an annoyance to all the lieges; and such as is private, *videlicet*, anything done to the hurt or annoyance of the lands, tenements or hereditaments of another, but which does not amount to trespass thereon."—Blackstone, 'Commentaries.'

is not kept longer than is necessary, and if it be proved that the best available means have been taken to prevent injury thereby to the public health.) It is not necessary that the accumulation should be unhealthy in order to be a nuisance: it is enough if it is offensive; it being the intention of the legislature to strike at two sorts of cases—anything which diminishes the comforts of life though not injurious to health, and anything which is in fact injurious to health." *(Bishop Auckland Local Board* v. *Bishop Auckland Iron Company.* 10 Q. B. D. 139.)

5. Any house or part of a house so overcrowded as to be dangerous or injurious to the health of its inmates, whether or not they are members of the same family.

Thus emphatically a house, or any part of it, in a state injurious to health, bad drainage, or overcrowding, is declared to be a nuisance.

It is the duty of every local authority to cause to be made, by their officers from time to time, inspection of their district, in order to ascertain what nuisances exist calling for abatement. It is not very clear what nuisances can exist which do not call for abatement, but presumably such an one as that mentioned above, an unhealthy deposit lawfully made in the course of business, and removed with all convenient speed. For this purpose it may be necessary to enter private houses; it must be so, of course, in numbers of cases. And as no man is bound to admit a stranger into his house against his will, except in execution of the law, provision is made by which when the local authority, or nuisance authority, as the case may be, have reason to suspect that a nuisance exists on any private premises, they may demand admittance. This they must do between fixed hours, viz., between nine in the morning and six at night, unless the nuisance is caused by a man's business, in which case they may demand admittance at any time during the hours when the business is being carried on. These hours would not appear to be very

fortunately chosen; they are the very hours when some of the worst evils of the worst parts of our towns must be impossible of detection; the vagrant element of our poor population is then in the streets; to see houses then is to see them in an abnormal state, and any inference drawn from their then condition may be falsified by their appearance a few hours later, when night has cleared the streets, and when the time of the inspector's visit is passed. Such, however, is the law. Should admittance be refused, the local authority must give written notice to the person refusing it, of its intention to apply to a justice for an order of admission, and the justice may, upon such application, make an order requiring the person in charge of the premises to admit the inspecting officer. If nobody can be found who has control of the premises, the justices may empower the local authority to enter them during the statutory hours; any person refusing to obey this order is liable to a penalty not exceeding £5, and the order once made remains in force until the nuisance, if found to exist, is abated.

Thus at the outset, the visit of the inspector of nuisances or officer of health, which is only warranted by suspicion of the existence of a nuisance, may be delayed by refusal of admittance; though it is true the refusal may entail upon the objector the costs of an application to a justice. It is well worth remark that in a dwelling house the officer of health can do nothing if a nuisance does not exist, however offensive or dirty the state of the premises; he cannot order them to be cleansed or ventilated; he must wait till the evil is done and then undo it, but he cannot take steps to prevent its ever coming into existence. It will be noticed when we come to speak of lodgings, that as regards them the law in this particular is different, as local authorities either now have—or can readily acquire—the power to make bye-laws to regulate the behaviour of their occupants, so as to prevent the first beginnings of evil—a provision most beneficial to lodgers themselves and to the public in general.

Cases, however, are unfortunately not unknown of officers failing to make proper inspection, and of nuisances either escaping or being concealed from their notice. That is no reason why a nuisance should go unabated, for if its existence is known to any person inhabiting the district, any person aggrieved, two inhabitant householders, any officer of the local authority, the relieving officer of the district, or any public officer of the district, information may be given of it to the local authority, who are bound to act upon it as if it had come through its proper channel, their medical officer. Or any person aggrieved by the nuisance, any inhabitant, or any owner of premises in the district may carry the complaint direct to a justice of the peace. Unfounded or frivolous complaints would entail the payment of costs by the person making them.

Assuming, however, that the information is brought to the notice of the sanitary authority (or the nuisance authority) what is their duty? It is their duty, if satisfied of the existence of the nuisance, to serve a notice of abatement on the person by whose act, default, or permission, the nuisance arises or continues; or they may include in the notice more persons than one, if it appears that two or more are responsible for it. In case, as is not improbable, such person cannot be found, the notice may be served on the owner or occupiers of the premises on which the nuisance arises. If, however, it is clear that the nuisance does not arise or continue by the act, default or sufferance of the owner or occupier of the premises, the local authority may themselves at once abate it without any further proceedings. This notice must require the person to whom it is addressed to abate or remove the nuisance within a specified time, and to do all works which may be necessary for the purpose; but in all cases where the nuisance arises from the want or defective construction of any structural convenience, the notice must be served upon the owner.

But who is the owner? The owner means the person for the time being receiving the rack-rent of the lands or premises in connection with which the word is used,

whether on his own account, or as agent or trustee for any other person, or who would so receive the same if such lands or premises were let at a rack-rent. This is the definition given by the Public Health Act: in the Metropolis the definition is rather narrower, "any person receiving the rents of property in respect of which the word is used, from the occupier of such property, on his own account, or as trustee or agent for any other person." It has been decided in the case of *Cook* v. *Montague*, L. R. 7 Q. B. 421, that a lessee who had sublet the premises, was not liable as owner for a nuisance caused on the premises by a tenant of his sublessee, on the ground that he did not receive the rent from the occupier: the person who ought to have been made liable was either the person causing the mischief, or the sublessee, because he received the rent from the person occupying the property upon which the nuisance existed. In that case it was said that the object of the Acts relating to nuisances was, on the one hand, that the expense of structural improvement should be thrown upon the owner, and that the local authorities should not be bound to proceed against temporary occupiers, who might not be worth powder and shot; but on the other hand, inasmuch as it might often be very difficult indeed to ascertain who were the real owners, and the collectors of rents might easily be found, this definition of "owner" was given, and in a vast number of cases they would thus reach the real owners, though sometimes, as in the present case, the definition would throw the burden on a person not intended.

The notice simply states that the local authority is satisfied of the existence of a nuisance, which it describes, and calls upon the person to whom it is addressed to abate it within a specified time; it further states that if such person makes default in complying with its requisitions, or if the nuisance, though abated, is likely to recur again, a complaint will be made to a court of summary jurisdiction for enforcing the abatement, or prohibiting the recurrence of the nuisance, and for receiving any costs and penalties.

If the person to whom this notice is addressed does not choose to comply with any of its requisitions, or if the nuisance is of such a kind that though temporarily stopped it is likely to recur again, it is the *duty* of the local authority to lodge a complaint before a justice. It is the *duty* of the justice thereupon to issue a summons requiring the person mentioned in the notice to appear before a court of summary jurisdiction, and it is the duty of the court, if satisfied that the nuisance exists, or that although abated it is likely to recur, to make an order upon the person requiring him to comply with the requisitions of the notice, and to take the necessary steps for abating or preventing the recurrence of the nuisance; at the same time the Court are to give directions as to costs. Thus in the case of *Ex parte Saunders*, 11 Q. B. D. 193, the Taunton urban sanitary authority served a notice on the owners of a house, in the centre of which was a water-closet of such construction as to be a nuisance, ordering them to remove it to a place near the outer wall, where there would be a thorough ventilation, and to fit it with certain pipes in a certain manner. It was urged on behalf of the owners that the order was bad; that though they could be ordered to abate the nuisance, it was beyond the powers of the justices to order any particular work to be done, or any particular appliances to be used. And reliance was placed upon a case of *Ex parte Whitchurch*, 8 Q. B. D. 547, where justices had ordered an owner to close an open closet which was a nuisance, and to build a pail-closet, and where the latter part of the order was held bad. The Court, however, distinguished *Ex parte Whitchurch*, and decided that the justices were entitled to decide what was necessary to be done in order to prevent the nuisance from recurring, and that the order was good.

This order may be addressed by the Court to the local authority itself, ordering it to abate the nuisance, under circumstances where the person responsible for the nuisance cannot be found, and the owner or occupier is not known. If the owner or occupier were known, but were not in any

way responsible, the local authority ought itself, where the person causing the nuisance cannot be found, to have abated it without ever going before a justice.

Where the nuisance is such that it renders the premises unsafe for human habitation, the Court may prohibit their use for that purpose until rendered fit. It would have been well here if the language of the statute had been *must* and not *may*. From that date until an order is made by justices that they are safe and habitable, they are neither to be let nor occupied. As will be seen further on (page 675) this is just the case to which Torrens's Acts apply—"premises dangerous to health so as to be unfit for human habitation." Under the above provision the owner may be punished by being deprived of the benefit which he derives from the use of his house, if proceedings are taken against him in respect of the nuisance. He may, moreover, be fined £5 for the offence, and a further penalty of 10*s.* a day if he disregards the order to abate. But if proceeded against under Torrens's Acts, he can force the local authority to buy from him at the "fair market value," in which case he frequently receives, as experience has shown, compensation utterly inadequate to the value of the buildings when in the hands of the local authority. A house *may* also be closed, under the Public Health Act, where there have been two convictions for overcrowding obtained within any period of three months. It is not necessary that the person convicted should be the same—the fact once established, the local authority may apply to justices, and they *may* order it to be closed for such time as they deem necessary. So under an Act regulating the Metropolis it is provided "that where any officer of health certifies to the nuisance authority that a house is so overcrowded as to be dangerous to the health of the inhabitants, and the inhabitants *consist of more than one family*, the nuisance authority must take steps to abate the nuisance, and the justice making the order may fine the person permitting the overcrowding a sum not exceeding £2 (18 & 19 Vict. c. 121, § 19). That section, however,

was many years antecedent to the law which declares *any* overcrowding in a house or part of a house a nuisance, and it would appear now to be immaterial whether the inhabitants consist of more than one family or not; for *every* case of overcrowding ought, as the law now stands, to be dealt with summarily.

Until the order to abate the nuisance, or to prevent its recurrence, has been complied with, the sanitary authority are empowered to enter the premises in order to inspect the works, or if nothing is being done, to execute any works which may be necessary in order to abate the nuisance; and in the latter case they are entitled to recover any expense to which they may have been put in a summary manner. The order of the justice is not, however, necessarily final; for any person against whom an order is made may appeal against it to the next meeting of quarter-sessions, provided he goes through certain formalities which do not require special mention in this place (38 & 39 Vict. c. 55, §§ 99, 269; 18 & 19 Vict. c. 121, § 40). Until the appeal is heard no liability to penalty arises, nor is anything to be done under the order; the whole matter is in abeyance until the decision of the final Court is given.

Numerous provisions exist with regard to penalties. Wherever the Court makes an order for the abatement of a nuisance, or an order prohibiting its recurrence, the person against whom the order is made may be fined not more than £5. A penalty of not exceeding 10*s.* a day is imposed wherever a person fails to obey an order to abate a nuisance. Violation of an order prohibiting the recurrence of a nuisance, or the occupation of a house unfit for habitation after it has been closed by the Court, is punishable by a fine of 20*s.* a day. If the occupier of any premises prevents the owner, against whom an order has been made, from carrying out its provisions, the owner may apply to a justice who will make an order commanding the occupier to desist, and to permit the execution of the works. A fine of £5 may be imposed for non-compliance with this order. Any person obstructing an officer or

other person acting in obedience to these Acts relating to nuisances is liable to a penalty of £5, and if two or more persons are concerned in the obstruction, the penalty may be distributed among them.

In the Metropolis, any penalties recovered by the nuisance authorities are to be applied in aid of the expenses incurred with regard to nuisances.

It will be remembered that a complaint may be made direct to a justice of the peace (p. 648) by any person entitled to do so (*i.e.* any person aggrieved, any inhabitant, any owner of premises in the district). In such a case proceedings are to follow just as if the complaint had been made in due course by the local authority to the justice. But the Court may, after the summons has been issued against the person alleged to be responsible for the nuisance, defer its judgment until the premises have been examined, and may make an order for the admission of whatever persons it thinks necessary in order to ascertain if the nuisance exists; matters then will proceed as if the initiative had come from the sanitary authority.

Full powers are given for recovering, either as a debt in a civil court, or summarily before justices, from any person against whom an order is made, the expenses of procuring it, and any expense incurred by the sanitary authority in relation to a nuisance. These expenses, if incurred against the owner, are not to exceed a year's rack-rent of the premises. The occupier of the premises for the time being may be called upon to pay them, so far as any rent is due from him to his landlord, and on payment he is entitled to deduct them from any rent which otherwise the landlord could claim, unless, as is sometimes the case, landlord and tenant have entered into any agreement with regard to payment of such expenses. In such case their relation is governed by the agreement, and not by the provisions of these Acts.

In all these matters the powers and duties of local authorities are confined, as might naturally be expected, to their own districts; but allowance is made to meet the

case of a nuisance affecting one district caused wholly or in part by something done or left undone outside it; in that case the authorities may take proceedings before justices who have jurisdiction in the district where the nuisance arises.

Many districts are governed by local Acts of Parliament which have similar or cognate provisions, as regards the duties of the local authority, to those contained in the Public Health Act or the Acts which regulate the Metropolis. It is expressly provided in the Public Health Act that the local authority shall not in such a case be exempted from any duty or obligation which the general law imposes, and the same construction, though not expressly provided, would no doubt be given to the Acts which relate to the removal of nuisances in the City or the Metropolis.

All expenses incurred by authorities in executing their duties in removing or preventing nuisances are to be paid out of the local rates.

Such, in brief, so far as regards nuisances, are the legal obligations in relation to the dwellings of the poor. They are perfectly simple, perfectly explicit, leaving no doubt on the one hand as to what is a nuisance, and no doubt on the other how it is to be treated. The necessary question follows, whether sufficient and efficient officers of health are provided for each district, which is of course a question of fact. There can be only one answer, if judged by results, and that answer is No. It is said that it is impracticable to put the law in force, that it is impossible to have "an army of sanitary inspectors." As a matter of fact large numbers of benevolent people are voluntarily doing in the worst parts of London what these Acts specially define as the duty of the inspectors of nuisances, going from house to house endeavouring to discover the material causes which lead to misery and sickness, and bringing them to the notice of the medical officer of health. There is no lack of work for them to do, and the work which they do is nothing else than the work which the officers of health—

or the local authorities by not appointing sufficient officers of health—have left undone. There is an instructive paragraph in a report of the Dwelling Committee of the Charity Organisation Society, published in August 1881, relative to this particular question. "In the Metropolis there are fifty-two vestries and local boards, each with a medical officer of health and three or four inspectors of nuisances, who have, besides the inspection of houses, other special work. There may thus be said to be two hundred and sixty persons taking care of the sanitary interests of a population of over four millions There is no common system in the administration of the sanitary laws in the different districts; the 'standard of habitability' varies: some of the medical officers are so paid that they can devote their whole time to the work; others are engaged also in private practice. In one or two districts there is regular periodical inspection; in most this is found impossible or considered needless." In an article in the 'Quarterly Review' of January 1884, a few simple statistics bearing out the same general statement will be found quoted, but it would be out of place here to do more than notice the accusation. No one can be surprised if nuisances exist where the authority whose duty it is to detect and abate them is either incompetent or inadequate; yet the wording of the Public Health Act leaves no room for doubt. "Every urban (or rural) authority *shall*, from time to time, appoint *fit and proper* persons to be medical officer of health and inspector of nuisances." "It shall be the *duty* of every local authority to cause to be made from time to time inspection of their district with a view to ascertain what nuisances exist calling for abatement . . . and to enforce the provisions of this Act in order to abate the same." So, in the Metropolis: "Every vestry and district board *shall* from time to time appoint *one or more* legally qualified medical practitioners or practitioners of skill and experience to inspect and report periodically upon the sanitary condition of the parish or district . . . and to point out the existence of any nuisance." So, the inspectors of nuisances

are "to report to the vestry or district board the existence of any nuisances."

It is scarcely necessary to point out that the extent of existing obligations is to be measured by the law which imposes them, and not by the manner in which they are discharged. It may be, and probably is, impossible to prevent entirely overcrowding, or to detect and remove all bad houses or other nuisances; but it is only right that it should be generally known that whenever a nuisance, as defined by the Public Health Acts or the Acts governing the Metropolis, exists, it exists not only in breach of the common law, but in express contravention of these Acts; and that the responsibility rests as much with the local authority who allow it to continue unchecked as with the person whose avarice or negligence brings it into existence.

It may be mentioned here that the Local Government Board exercises a qualified supervision over local authorities; and that where complaint is made to it that any local authority has made default in enforcing any provisions of the Public Health Act which it was their duty to enforce, the Local Government Board may make an order, provided it is satisfied that the authority has been guilty of the alleged default, limiting a time for the performance of their duty in the matter of such complaint. If the duty is not performed within that time, the Local Government Board may either apply to the Court of the Queen's Bench for a *mandamus*, calling upon the local authority to proceed to do its duty, or appoint some qualified person to perform such duty, and charge his reasonable remuneration to the authority in default.

III. Cellar Dwellings.

The use of cellars, or underground rooms, as separate dwelling-places is placed under stringent regulations. Any cellar in which a person passes the night is considered a dwelling. In so much of England as is governed by the Public Health Act, persons are prohibited from letting, or

occupying, or allowing to be occupied, any cellar or vault which has been built or rebuilt since 1875 (38 & 39 Vict. c. 55, § 71). With regard to others, their height, ventilation, drainage, and appurtenances, are the matter of careful and exact provision. Thus it is unlawful to let any cellar to be used as a dwelling unless it is seven feet high, and unless three feet of its height at least is above the surface of the street or adjoining ground; unless the drains pass at least a foot below the level of the floor; and unless it has a fireplace with a proper chimney or flue. Any person offending against these provisions is liable to a penalty of twenty shillings for every day that the occupation continues after the local authority has given him notice in writing. After two convictions, whether against the same person or not, a court of summary jurisdiction may order the cellar to be permanently closed, or may give the local authority power to do so. Provisions to all intents similar are in force in the Metropolis, except so far as relates to cellars built or rebuilt since 1875 (18 & 19 Vict. c. 120, § 103). Under the Metropolis Local Management Act (25 & 26 Vict. c. 102, § 62) it is the duty of the district surveyor to report to the Metropolitan Board of Works, and to the vestry or district board of his district, in June and December of each year, all underground rooms or cellars occupied as dwellings which are not built in conformity with the law, and their exact locality and situation. The penalty, which is recoverable after notice from the local authority, is divisible between the informer, who is entitled to one half, and the local authority who takes the other.

IV. New Buildings.

Although we are dealing more particularly with what the law does at present to check evils now in existence, it may not be out of place to say a word as to new buildings Both in the Metropolis and elsewhere every local authority must appoint a surveyor, whose duty it is to see that the requirements of the law as regards buildings are duly

observed. Very ample powers are given to urban authorities to regulate their construction and arrangement. The Public Health Act gives to these authorities power, *i.e.* permits them, to make bye-laws for their districts, dealing with the width of new streets and their drainage, the structure and foundations of new houses, for securing stability, and for the purposes of health ; also to provide for sufficiency of space being left about new buildings so as to secure a free circulation of air, and to regulate the ventilation of the buildings, and the supply of adequate drainage arrangements and offices. To secure this the urban sanitary authority *may* cause persons intending to build to give notice of their intention, and may order plans of the proposed new buildings to be deposited at their office. With these plans they may express their assent or dissent, and in the latter case the works as proposed are not to proceed. Further, if the buildings are commenced after the plan has been disapproved of, or before a month has elapsed after its being deposited with the local authority, unless their sanction has been previously obtained, the authority may cause them to be pulled down. It rests entirely with the urban authority to make, or not to make, bye-laws in accordance with the powers thus given ; but all bye-laws must be submitted to and confirmed by the Local Government Board before they become law ; when made and sanctioned they are as binding as the Act of Parliament which gives power to make them. In the same way the Metropolis Management and Buildings Acts Amendment Act, 1878, recites the expediency of making provision as regards new buildings for purposes of health, and gives powers to the Metropolitan Board of Works to make bye-laws of the same character as those just referred to. These bye-laws require the confirmation not of the Local Government Board, but of one of the principal Secretaries of State. The Metropolitan Building Act of 1855 expressly enacts that every habitable room thereafter constructed in any building, except rooms in the roof, and cellars, shall be at least seven feet high, and that whoever permits any person

to pass the night in any room not fulfilling this requirement shall be fined not more than twenty shillings for each day that the offence continues. The regulations at present in force in the Metropolis will be found in the bye-laws of the Metropolitan Board of Works. It is constantly stated that numbers of houses have been, and are being, built in the Metropolis in direct disregard of the provisions of the Building Acts. If this is so, it is only another instance of the inefficiency of legislation to deal with evils when unsupported by an energetic executive, and of the necessity of appointing officers not only competent in ability to discharge the duties of their position, but adequate in numbers to perform them effectually.

V. Lodgings.

So far as we have gone at present, it is obvious that a nuisance must exist before the law can interfere. If a man and his family choose to live in a state of filth and discomfort and degradation, they are free to do so, so long as they stop short of a legal nuisance. There is, as a rule, no power to order sanitary precautions to be adopted in a man's own house, to bid him keep it clean, ventilated, or well ordered. He owes, so to speak, no legal duties to himself. True, the inspector of nuisances may insist on admission on his periodical visit, but unless the nuisance exists he is powerless, and even then his entry must constantly be resented as an arbitrary invasion of privacy. But with regard to certain classes of houses, or rather houses occupied upon certain terms, the law is different. Over *lodging-houses*, as distinct from *dwelling*-houses, the local authority has what may be called *preventive* as well as remedial power, for it can provide for cleanliness, order, and decency, so far as law can provide for them, and can see that the provisions are obeyed. Lodging-houses may be divided into three different kinds, and the jurisdiction of the local authority will differ as regards each class.

(1) Ordinary lodging or "tenement" houses, where the

landlord lets one room, or part of the house, to one family, and another to another, himself keeping the general control over the house.

(2) Common lodging-houses, where persons strangers to one another are allowed to inhabit one common room.

(3) Houses built or to be built under the Artisans' and Labourers' Lodging-houses Acts.

1. As regards ordinary lodging-houses, they are not necessarily subject to any regulations or restrictions. A person living in lodgings differs, as such, in no respect from a person living in his own house. But there exists in the Local Government Board the power to place them under the regulation of bye-laws. Thus by an Act of Parliament passed in 1874 the Local Government Board was empowered in its discretion, after due publication in the Gazette, to give the various local authorities in the Metropolis the right to make bye-laws for the management and control of lodging-houses in their districts; and by an Act of 1875 (the Public Health Act) this power might be given, at their own request, to any sanitary authorities elsewhere. The consequence of this would be that the local authority would be empowered to make bye-laws for the following matters:

1. For fixing, and from time to time varying, the number of persons who may occupy a house, or any part of a house, which is let in lodgings, or occupied by members of more than one family; and for the separation of the sexes in a house so let or occupied. The Act speaks of "a house or part of a house." It is clear that a house, in the sense of an entire building, may be split up into several dwellings, each let to separate persons or families. These will be lodgings if the landlord retains control over the house, or separate tenements if he has parted with it. Any dweller, however, in one of these separate tenements can make it a lodging by allowing a third person to live there, and taking payment for his accommodation. (See *per* Maule, J., 5 C. B. 23, and *Bradley* v. *Baylis*, 8 Q. B. D. 203.)

2. For the registration of such houses so let or occupied.
3. For their inspection.
4. For enforcing drainage and the provision of privy accommodation for such houses, and promoting cleanliness and ventilation.
5. For the cleansing and lime-washing at stated times of the premises, and for the paving of the courts and courtyards.
6. For the giving of notices and the taking of precautions in case of any infectious disease.

This power of the Local Government Board seems to have been very sparingly made use of, if at all, until very recently, when active steps have been taken under it which promise, if only the local authorities will co-operate in the movement, to be productive of great public advantage. On December 29, 1883, the Local Government Board issued a circular letter to the local authorities of the various districts and parishes in the Metropolis, stating that they felt assured that a judicious exercise of the powers above referred to might secure a material improvement in the sanitary conditions of the dwellings of the poorer classes, and formally conferring upon them the power to make bye-laws. At the same time they enclosed suggestions for regulations which should be made in pursuance of these powers, in the shape of a draft of bye-laws, for the consideration of the local authority. These are carefully and comprehensively framed to secure the houses to which they relate being kept healthy and wholesome. They impose, and enforce with a fine, reciprocal duties upon both landlord and lodger. The former must allow to every inhabitant a fixed number of cubic feet of air, must maintain the offices of the house in good order, must keep the common staircase and courtyard clean, and once a year at least must thoroughly cleanse and whitewash the whole house. The latter is bound to wash and cleanse his room, and to remove all refuse daily. As the houses are to be at all times open to the visit of the inspector of nuisances, any omission to conform with the rules can be readily detected

and corrected, and the discipline quickly and firmly enforced. In places other than the Metropolis similar powers are conferred by the Local Government Board at the request of the local authorities. Thus in the report of the Board, 1882–83, it is said "we have declared the enactment contained in § 90 of the Public Health Act 1875 (the section which enables these powers to be conferred) to be in force within the districts of the urban sanitary authorities of Benwell and Fenham, Croydon, Edmonton, Gloucester, Heston and Isleworth, Ramsgate, and St. Helen's (Isle of Wight), and within four contributory places in the rural sanitary district of the Whitchurch Union, for the purpose of empowering the authorities to make bye-laws for fixing the number of the persons who may occupy houses let in lodgings, for the separation of the sexes, for the registration and inspection of such houses, and for their drainage and cleansing."

The practical result of this measure is that it is now in the power of all local authorities in the Metropolis, and in many other places, to *oblige* all persons letting and occupying lodgings, and every one who inhabits a house or part of a house occupied by members of more than one family, to perform such domestic duties, and to take such sanitary precautions, as the local authority may think fit to order, and to maintain cleanliness and decency, upon pain of a fine. It is almost needless to say that it is only in certain districts, and among a certain class of houses, that such discipline requires to be enforced. It is entirely in the discretion of the local authority when they make their bye-laws to exempt from their operation houses where interference is unnecessary. That may be done, as suggested by the draft bye-laws framed by the Local Government Board, by fixing a certain rateable value, and a certain minimum sum for weekly rents, and exempting houses whose rates and rent are in excess of the standard, or it might be left in many districts to the discretion of the officers of health. The popular suggestion that bad districts should be "proclaimed," and periodically inspected

at short invervals by an efficient staff of officers, whose duty it should be to enforce with rigour the provisions of the law of nuisances, would thus be rendered superfluous in all cases of lodgings, where the bye-laws should make the existence of nuisances impossible. It should be impossible, for instance, that such houses should be overcrowded, just as it should be impossible that they should be insanitary, without detection. In places where local authorities have not this power already, it awaits their asking. Here again the law says they *may* make bye-laws, and not they *must*, so that it remains to be seen what advantage will be taken of these new powers. Vigorously applied they are capable of doing incalculable good, as there is no need in these cases to wait until a nuisance exists. The houses are at all times to be open to the visit of the Inspector of Nuisances (assuming the local authority to make the bye-laws), and it would be his duty to see that the bye-laws were carried into effect. Their immediate effect would be nothing more than the mere perfunctory prevention of filth and immorality and disease, but indirectly they could not fail to lead to invaluable habits of decency and order.

VI. Common Lodging-Houses.

A common lodging-house may be defined as that class of lodging-house where persons of the poorer classes are received for short periods, and although strangers to one another, are allowed to inhabit one common room. In the Towns Police Clauses (1847), a more comprehensive definition is to be found, as a common lodging-house is there defined as "Every house in which persons are lodged for hire for less than a week at a time, or any part of which is let for any term less than a week;" while the Public Health Act, and the Acts relating to the removal of nuisances in the Metropolis, contain no definition of the word at all. The first Act of Parliament which related to them was passed in 1851, and embraced the whole of

England. It was repealed, except as regards the Metropolis, by the Public Health Act 1875; but its provisions, as amended by subsequent Acts, govern the Metropolis still. The rest of England depends on the clauses of the Public Health Act. Every local authority is bound by law to have a register of the persons keeping common lodging-houses, their situations, and the number of persons they are authorized to accommodate. In this case the local authority are under a legal obligation, whereas, in the case of ordinary lodging-houses, they are only *empowered* as distinct from *obliged*. Before any person is permitted to keep such a house, it is necessary that it should first have been inspected and approved, and the character of the proposed keeper vouched for, if the local authority so demand. To keep such a house without its having been previously registered, subjects the keeper to liability to a fine not exceeding £5, and a further penalty of forty shillings a day as long as the offence continues.

As regards all common lodging-houses within their district, the local authority *must* make bye-laws, (1) for fixing the number of inhabitants; (2) for the separation of the sexes; (3) for promoting cleanliness and ventilation; (4) and generally for their well-ordering. Notice of infectious disease is at once to be sent to the medical officer of health by the keeper, who may also be required to report to the local authority, or its officer, all beggars and vagrants who have resorted to the house during the previous day and night. Twice, at least, every year, the keeper is to limewash the walls and ceilings, to the satisfaction of the local authority; and the house is at all times to be open to the inspection of their officers. In the Metropolis, therefore, the local authority have now the fullest power to superintend and control all houses whatever, which are let in lodgings, whether "common" or otherwise, particularly to determine how many persons are to be accommodated in them, and to make provisions for their decency and order. If, then, any house occupied by members of more than one family is overcrowded in the Metropolis, it ought

to be in contravention of the bye-laws of the local authority, which may subject the owner to a penalty; it certainly is a nuisance, and punishable under the Sanitary Acts. In places other than the Metropolis common lodging-houses alone are liable to this power of supervision and control, except in the few districts referred to in the preceding page. There is no doubt, however, that similar powers would be extended at once to any local authority which chose to apply for them.

VII. Labouring Classes' Lodging-houses.

(14 & 15 Vict. c. 34; 29 Vict. c. 28; 30 Vict. c. 28.)

One more statute with regard to lodging-houses remains to be noticed. A scheme was devised in 1851, and embodied in an Act of Parliament of that year, by which local authorities may themselves build or acquire lodging-houses, and become landlords to the labouring class in their district. Its object was to enable local authorities to do what a number of philanthropic societies have been recently doing, to purchase, organise, and manage lodging-houses, so as to secure to tenants the due fulfilment of the landlord's duty. It did not propose, in any way, to introduce or countenance a system of throwing upon the districts the expense of providing houses for their lowest classes. Not only is this clear, from the general provisions of the Act, but it is expressly provided by the 49th section, that "any person who, at any time, while a tenant or occupier of a lodging-house or part of a lodging-house, or whose wife or husband, receives relief, other than relief granted on account only of accident or temporary illness, is thereupon disqualified for continuing as a tenant or occupier." The Act is "permissive," simply giving the local authority the power, without making it a duty; and as is well-known, has hitherto—whether for reasons of expense, or otherwise—been a failure, advantage having only in a single instance been taken of its provisions.

It recites that it is desirable for the health, comfort, and welfare of the inhabitants of towns and populous districts, to encourage the establishment therein of well-ordered lodging-houses for the labouring classes, and gives most extensive powers in furtherance of that object. Its application is limited to urban sanitary districts, or, with the approval of the Secretary of State, to any parish which has, according to the latest census, a population of not less than 10,000 persons. Two or more parishes, however, if desirous of taking advantage of the Act, and, if their population in the aggregate reaches the required number, may concur to carry it jointly into execution.

Any urban sanitary authority may adopt it on complying with certain requisite preliminaries, such, for instance, as giving public notice of intention to consider the propriety of adopting it, and of the time and place where such consideration will be held. The meeting may, however, be required to be postponed until after the next election of members of the local authority, on presentation of a memorial signed by not less than one-tenth in value of the ratepayers. It will then come on for discussion in due course, at the next meeting after the election, and be entertained or rejected as the majority of the local authority may determine. In parishes where the Act can be adopted—*i.e.*, over 10,000 inhabitants, either singly or combined—the initiative comes from the ratepayers, any ten of whom may call upon the churchwardens to convene a meeting of the vestry to discuss the adoption of the scheme. After three weeks' notice, the vestry may resolve, by two-thirds in value of the votes on the question, to adopt it, in which case a copy of the resolution is to be forwarded to the Secretary of State for his approval. If this is granted, the vestry may proceed at once to appoint persons to carry out the Act. These are to be ratepayers of the parish, in number not less than three nor more than seven, one-third of whom are to go out of office yearly, but are to be re-eligible. These persons are to be styled Commissioners for lodging-houses, and form a

corporate body, with power to hire offices for the purpose of their business, and to appoint a clerk and any necessary officers. They are to meet once a month, if not oftener, and are to record the minutes of their proceedings in a book, which is to be signed by two of them. The authorities, then, entrusted with the execution of the scheme, will be the Commissioners in parishes, and the urban sanitary authority elsewhere. Power is given them to appropriate any land which is vested in the local authority for the general benefit of the district to the purpose of affording sites for lodging-houses. Should their own land not be suitable, they may exchange it for any that is. They may purchase land, or rent it. On this they may build lodging-houses for the labouring classes, or, if buildings already exist, they may convert them into suitable dwellings ; they may enter into any contracts for building or altering ; but should any exceed in value £100, they must advertise it in the district for public tender. They may buy up lodging-houses already existing, or they may take over the management of any such houses which may be vested in trustees in their district. In a word, the local authority has, by this Act, as full powers as any individual or company to buy, or build, or acquire in any way, lodging-houses for the poor of their district. All houses so acquired, or put under their management, are to be subject to their control and regulation, for which purpose they are entitled to make bye-laws, and to punish any breach of them with a fine not exceeding £5. These bye-laws must, before they become valid, receive the sanction of the Secretary of State, and are to be directed to the following purposes :—

(1.) For securing that the lodging-houses are under the management and control of the officers, servants, or others employed for that purpose by the sanitary authority or Commissioners.

(2.) For securing the due separation at night of men and boys above eight years old from women and girls.

(3.) For preventing damage, disturbance, indecent and offensive language and behaviour, and nuisances.

(4.) For determining the duties of the officers, servants, and others appointed by the sanitary authority or Commissioners for these purposes.

It remains to consider how the expenses necessary to carry the Act into execution are to be met. They are to be paid in boroughs, improvement districts, or local government districts, out of the local rates, which the authorities are empowered to increase for this purpose. In parishes they are to be paid out of the moneys applicable to the relief of the poor, to such extent as the vestry may sanction, after having been duly convened, with notice of the amount which is proposed to be applied to these expenses. The amount so sanctioned may be levied by the overseers as part of the rate for the relief of the poor, and is to be paid by them, according to the orders of the vestry, to the person authorised by the Commissioners to receive it. Those moneys, and whatever may be received as rent from lodging-houses, are to be devoted to paying the expenses of the Act in the parish; and if in any one year there should be a surplus, after paying interest on money borrowed, and debts incurred by the Commissioners, and after reserving sufficient to meet next year's probable expenditure, this surplus is to be repaid to the overseers in aid of the rates for the relief of the poor. In urban sanitary districts, the receipts arising from the lodging-houses are to be paid to the credit of the fund out of which the expenses have to come; but all receipts, payments, credits or obligations in respect of lodging-houses are to be kept in a separate account, called the lodging-houses account.

The accounts of both the sanitary authority and the Commissioners are to be annually audited, the latter by two independent persons appointed by the vestry, or by the Poor-law auditor; the former in the manner provided by law for the general audit of their accounts.

The authorities who carry out these Acts are allowed to borrow the money necessary for the purpose, the sanitary authority with the approval of the Treasury, the Commissioners with the approval of their parish vestry. As security they may mortgage their rates, or any fund out of which the expenses of the lodging-houses would be payable. And the following provision is made with regard to public loans, applicable, moreover, not only to local authorities, but to any railway company, or dock or harbour company, or any other company, society, or association established for the purposes of, or desirous of promoting the Labouring Classes' Lodging-Houses Acts. It may also be taken advantage of by any private person entitled to any land for an estate in fee simple, or for any term of years absolute, of which not less than fifty remain unexpired.

"The Public Works Loans Commissioners may, out of the funds for the time being at their disposal, from time to time advance on loan, to any sanitary authority, and to the Commissioners of a parish, and to any local authority acting under the Nuisances Removal Acts, and these authorities respectively may from time to time borrow from the Public Works Loans Commissioners the money required for the purpose of the Labouring Classes' Lodging-Houses Acts, subject to the following provisions:—

"1. The loan must be made for the purpose of assisting in the purchase of lands and buildings, or in the erection and alteration of buildings to be used as dwellings for the labouring classes, and for providing all conveniences which may be deemed proper in connection with them.

"2. An advance may be made whether the bodies above referred to had or had not power to borrow on mortgage independently of these Acts.

"3. No sum can be advanced without the approval of the Treasury to the borrowing of it, signified by writing under the hand of one of their secretaries or assistant-secretaries.

"4. The Treasury may make such regulations as they from time to time think proper with respect to applications for such advances, and the terms on which they are to be made, and they may issue such instructions and forms as they may think fit, for the guidance of persons applying for loans or executing works or rendering accounts of moneys expended under these Acts; or regarding the class of dwellings towards the providing of which loans are to be made, and their adaptation to the purposes intended, and as to the mode of providing for their maintenance, repair and insurance.

"5. The period for the repayment of the sums advanced cannot exceed forty years.

"6. The repayment of the money advanced, with interest at the rate agreed on, but not at a less rate than 4 per cent., must be secured either by mortgage solely of the rates leviable by the borrowing body, or by a mortgage of their estate or interest in the lands or dwellings for the purposes of which the advance is made, or both. Any mortgage may be taken either alone or together with any other security which may be agreed upon, but it is not incumbent on the Public Works Loans Commissioners to require any other security.

"7. No money can be advanced on mortgage of any land or dwelling solely, unless the estate therein proposed to be mortgaged is either an estate in fee simple, or an estate for a term of years absolute, of which not less than fifty years remain unexpired at the date of the advance.

"8. The money advanced on the security of a mortgage of any land or dwellings solely must not exceed half the value, to be ascertained to the satisfaction of the Public Works Loans Commissioners, of the estate or interest in the land or dwellings proposed to be mortgaged; but advances may be made by instalments from time to time as the building of

dwellings on the land mortgaged progresses, so that the total advance does not at any time exceed the above-mentioned amount, and a mortgage may be accordingly made to secure the advances from time to time.

"The words 'lands or dwellings' include any land, buildings or premises held together with and for the same estate and interest as the lands, buildings or premises upon which the money advanced is to be expended."

Seven years was assumed to be the time necessary to give the experiment a fair trial, for at the end of seven years the sanitary authority, or the vestry, may determine that their lodging-houses are unnecessary or too expensive. In that case they must obtain the approval of the Treasury; after which they may sell them for the best price they can obtain. The proceeds of the sale are to be applied, first of all, in payment of all debts, liabilities and engagements of the sanitary authority or Commissioners, as the case may be, incurred with regard to the lodging-houses, and the surplus, if any, is to be paid to the fund out of which the annual expenses of the houses had been hitherto paid.

It may be convenient here to notice a clause in the recent Municipal Corporations Act, 1882,* which bears upon the subject of lodgings for the labouring classes. It is to be found in that part of the Act which deals with corporate lands, and provides as follows:—

"(1.) If a municipal corporation determines to convert any corporate land into sites for working men's dwellings, and obtains the approval of the Treasury for so doing, the corporation may for that purpose make grants or leases for terms of 999 years, or any shorter term, of any parts of the corporate land.

"(2.) The corporation may make on the land any roads, drains, walls, fences, or other works requisite for converting the same into building land, at an

* 45 & 46 Vict. c. 50, s. iii.

expense not exceeding such sum as the Treasury approve.

"(3.) The corporation may insert in any grant or lease of any part of the land provisions binding the grantee or lessee to build thereon, as in the grant or lease prescribed, and to maintain and repair the building, and prohibiting the division of the site or building, and any addition to or alteration of the character of the building, without the consent of the corporation, and for the re-vesting of the site in the corporation, or its re-entry thereon, on breach of any provision in the grant or lease.

"(4.) All costs and expenses incurred or authorised by a corporation in carrying into execution or otherwise in pursuance of this section, shall be paid out of the borough fund and borough rate.

"(5.) In this section the term 'working men's dwellings' shall mean buildings suitable for the habitation of persons employed in manual labour and their families; but the use of part of a building for purposes of retail trade or other purposes approved by the Council shall not prevent the building from being deemed a dwelling."

Such is the present state of the law as regards lodgings, ample, it would appear, to keep them wholesome and healthy. Since the Acts relating to common lodging-houses came into operation, it is said: "They are now sweet and clean, whereas before they were dens of misery and filth; fever used to be dominant in them, thirty or forty cases sometimes occurring in a single week, but during the last thirty years only two cases of fever have been reported in them." It rests entirely with local authorities to make the same report true of all houses whatever which are let in lodgings, for in the Metropolis and many other places they have already the power, if they care to use it, to compel the observance of sanitary precautions to the same extent as in common lodging-houses, and to limit the number of occupants; and in such places as it

does not yet exist, it simply awaits their application for it. As by far the greatest number of the houses inhabited by the lowest classes of the poor fall under the description of lodgings, further legislation as regards them seems at present to be quite unnecessary, if only means can be devised to induce the persons who have the power of so doing, to put the existing provisions into strict execution, and to take practical steps to ensure breaches of their bye-laws being detected and visited with summary penalties.

VIII. THE ARTISANS' DWELLINGS ACTS, 1868–1882.

(Torrens's Acts.)

We now pass to an entirely different branch of the law, which may be distinguished from the law relating to nuisances by describing it as proceeding against the thing which does the evil rather than against the person who causes or permits it. Torrens's Acts apply solely either to decayed or dilapidated houses, in themselves dangerous to health, or to houses which, themselves habitable, make others dangerous, and they provide means by which the owner can be compelled to demolish or reconstruct them, or to sell them to the local authority for that purpose.

In the Report of the Artisans' and Labourers' Dwelling Acts, published in June, 1882, it is said: "These Acts proceed upon the principle that the responsibility of maintaining his houses in proper condition falls upon the owner, and that if he fails the law is justified in stepping in and compelling him to perform it. They further assume that houses unfit for human habitation should not be used as dwellings, but ought, in the interests of the public, to be closed and demolished and subsequently rebuilt. The expropriation of the owner is thus a secondary step in the transaction, and only takes place after failure of other means of rendering the houses habitable." It will be seen at once that the remedies they create must co-exist in part with the remedies already noticed as applicable to

nuisances; but they go much further, inasmuch as *the owner* of premises can, under them, be called upon to pull down the unhealthy house or to repair it, whereas under the Nuisances Acts it was *the person who caused it* who was held responsible for the nuisance. In the amending Act of 1879, the purposes of the Acts as regards the Metropolis are expressly defined (and it may be assumed that their purposes there are cognate to their purposes elsewhere) to be as follows:—

1. The providing of the labouring classes with suitable dwellings within the jurisdiction of the local authority, by the construction of new buildings, or the improvement of existing ones.
2. The opening out and widening of closed or partially closed alleys and courts inhabited by the labouring classes, by pulling down any buildings, and leaving such open spaces as may be necessary to make the alleys or courts healthful.

For these purposes, the owner of a house dangerous to health, so as to be unfit for human habitation, *must* be ordered to repair or demolish it. A legal obligation rests upon the local authority to make this order, and to enforce it unless the owner prefers to sell his premises. But with regard to buildings which are not in themselves uninhabitable, but are only obstructive to the habitability of others, the local authorities are *empowered*, as distinct from *obliged*, to take steps for their purchase and demolition.

The Acts apply to Scotland and Ireland as well as England, and were limited in the first instance to urban sanitary districts having a population, according to the latest census, of over 10,000. This limitation of number, however, has now been removed by one of the amending Acts, so as to bring all urban sanitary districts within their scope; they thus govern the City of London, the Metropolis, and urban districts. The authorities entrusted with their execution are the same as those who were entrusted with the removal of nuisances, viz., the Commissioners of Sewers in London, the various vestries or boards of works

in the Metropolis (or in their default the Metropolitan Board of Works), and the urban sanitary authorities (see p. 13) elsewhere. Here, also, the primary responsibility rests upon the officer of health, defined to include medical officer of health, sanitary inspector, or any officer performing that duty; but in a later Act (1869) it is provided: "That as respects any urban sanitary district in England this term shall mean *only* the medical officer of health appointed by the urban sanitary authority."

The Act is put in motion by a Report of the officer of health to the local authority. It is his duty to report to them any premises in his district which he finds "dangerous to health, so as to be unfit for human habitation." It was his duty, as will be remembered, under the Acts relating to nuisances, to report to them any premises in such a state as to be injurious to health. The original Act of 1868 dealt only with premises in themselves noxious and uninhabitable, but the amending Act (1882) enables and orders the officer of health to report to the local authority any buildings which, though themselves habitable, are so built or situated that they tend to make adjacent dwellings unfit for habitation, by stopping ventilation or otherwise, or which stand in the way of effectual measures being carried out for the purification or proper construction of others. Buildings of this class are called "obstructive" buildings, and when the medical officer makes his report, he is to state the particulars of any such obstruction, and that in his opinion it is expedient it should be pulled down. Thus under Torrens's Acts the duty of the medical officer is to acquaint himself with (1) the existence of dwellings dangerous to health, so as to be unfit for human habitation; (2) obstructive dwellings, and to report them to the local authority. The following copy of a recent report of an officer of health will give a practical illustration:—"Gentlemen, I hereby declare the following premises to be in a state dangerous to health, so as to be unfit for human habitation, viz., the houses in Bishop's Court, Slade's Place, and Smith's Place. The great mor-

tality in Bishop's Court might be prevented by the removal of the obstructive buildings, the back yards of 19 and 20 St. John's Square, and the houses 6½ Bishop's Court, and 18 St. John's Square. The premises in Slade's Place and Smith's Place require entire reconstruction or demolition." This report must be in writing, signed by the medical officer, and handed to the clerk. The clerk is the person to whom all communications addressed to the local authority upon these matters ought to be sent, and upon whom summons or notice of any legal proceedings against them may be served; he may also represent them in proceedings in any court of law.

On receipt of the report, the local authorities are to refer it to a surveyor or engineer, who is thereupon to consider it and inspect the locality; he also is to make a report to the local authority, differing in kind according as the building referred to his inspection was stated to be uninhabitable or merely obstructive. In the former case he must report what is the cause of the evil, and how it can be remedied; and if it is occasioned by defects in the premises, whether the evil can be remedied by alteration in the structure of the buildings, or how otherwise, and whether in his opinion the buildings, in whole or part, ought to be demolished. In the latter case he must verify and report upon the statements made by the officer of health, and state his estimate of the cost of pulling the building down and acquiring the land on which it stands.

It will be convenient now shortly to deal with the proceedings which follow on the report of the surveyor, when it states that the buildings to which he was referred are themselves uninhabitable.

The local authority, upon receipt of the Report, must cause a copy of it, and of the report of the officer of health, to be sent to the owner. *Owner* is defined as meaning any person who is enabled to sell lands or premises, and all lessees or mortgagees, except persons entitled to the rents and profits for a less period than twenty-one years (31 & 32 Vict. c. 130, s. 3). Practically, therefore, it

means all persons interested, except lessees for a shorter period than twenty-one years. The local authority must also inform him, or them, of the time and place where they will take the reports into consideration. The owner, or owners, may attend there, and raise any objection to either, or though admitting that the proposed works are necessary, may urge that they are not responsible for the state of the premises, but that repairs ought to be done at the expense of some other person, or of the parish or district. If the local authority decide that any owner is responsible, he may appeal (see p. 682), but he must first give written notice of his intention, and of his reasons, to the persons whom he alleges to be responsible, in order that they may put in an appearance when the appeal is heard. Should the local authority, however, decide that some persons other than the owner before them are responsible, copies of the reports upon which the proceedings have been based must be sent to them, together with notice of a time and place where they may appear and raise any objections they think fit.

After the consideration, the local authority *must* make an order to the effect that the buildings must be repaired or demolished, or that they are not in such a state as to be uninhabitable. This must be in writing, signed by their clerk, and is subject to appeal. If they overrule any objections which may have been raised to the report, they may at once proceed to cause a plan and specification of the necessary improvements, together with an estimate of the costs, to be made out. Notice has again to be sent to the owner, informing him that the plan and estimate is prepared, and may be inspected or copied at the clerk's office. Within three weeks the owner may raise any objections to either, and should he do so, the local authority must fix a time and place to consider them ; another order must then be made, allowing the objections or dismissing them. If they are allowed, the plans or estimates are to be modified or altered accordingly, and when so amended are to regulate the execution of the work.

And just as we have seen in the case of nuisances, where

the primary duty is on the officer of health to detect and report them, certain private persons can set the law in motion (page 648), so here, if four or more householders in or near any street* represent in writing to the officer of health that any premises near the street are in a state dangerous to health, so as to be unfit for human habitation, he must forthwith inspect and report upon the premises. Absence of such representation, however, does not excuse him from inspecting and reporting unhealthy premises. Should the local authority neglect, for three months after receiving the report, to take proceedings upon it, the householders who signed the representation may address a memorial to the Local Government Board asking for an inquiry, and the local authority may thereupon be directed by them to take proceedings at once.

Under the original Act, the order addressed by the local authority to the owner left him no option, subject to successfully appealing against it (p. 682), but to proceed to execute the works, or to decline to do so, in which case the local authority had power to shut up the premises or demolish them, or to execute the necessary works at his expense. The amending Acts introduce a most important alternative, as under them the owner of premises specified in the order requiring their demolition or reconstruction may call upon the local authority, by writing addressed to them, within three months after service of the order, to buy the premises or his interest in them.

Should he do so, the local authority may agree with him as to what the amount of purchase-money shall be; but failing agreement the compensation is to be settled by arbitration. For this purpose the arbitrator is appointed, and removable by, the Local Government Board. The statute lays down rules by which the arbitrator, in settling the amount, is to be governed.

"(1.) The estimate of the value of the premises is to be based on their fair market value, as estimated at

* "Street" includes any court, alley, street, square, or row of houses.

the time of the valuation, and of the several interests in them, due regard being had to the nature and then condition of the property, and the probable duration of the buildings in their existing state, and to their state of repair, and without any allowance being made for compulsory purchase."

It has been pointed out, very justly, that the expression "fair market value" is fallacious if the rental which the building brings is taken as the criterion. A house let for immoral purposes commands a higher rental than an ordinary dwelling-house; a house invariably over-crowded is worth more to its owner than a house in which only a proper number is accommodated. "Fair market value" ought to be held to mean fair market value if the premises were used in a proper and legitimate way.

"(2.) The arbitrator is to take into consideration, and make allowance for, any increased value which premises of the same owner may receive by the demolition or destruction of those which the local authority are thus acquiring. Thus a reduction will be made in the amount of compensation proportionate to the benefit, if any, which other houses of the same owner may acquire by the improvement."

The arbitrators appointed to assess compensation under Sir Richard Cross's Acts have adopted two further rules which may be mentioned here, as being applicable as well to valuations made under Torrens's Acts.

"(3.) A house so unhealthy as to be irreparable is not to be considered as a house at all, but simply as the site of a house with a heap of building materials upon it.

"(4.) In valuing such a piece of land, regard is to be had to its 'evil surroundings.'"

The arbitrator may also, at the request of the person who has called upon the local authority to buy, certify what, in his opinion, is the proper amount of costs incurred

by him in relation to the arbitration; and the local authority is bound to pay these within seven days of the certificate, after which time interest at 5 per cent. begins to run. But where the local authority, previous to going to arbitration, has made an offer, and the award does not exceed the amount originally offered, the owner is not entitled to have his costs allowed him.

The award of the arbitrator is final and binding upon all parties.

The lands or houses thus acquired by the local authorities are to be employed in carrying out the objects of these Acts. First they may take down the uninhabitable premises, and build upon the sites thus cleared dwellings suitable for the working classes; should they do so, they have full powers under these Acts to make, alter, or repeal bye-laws for regulating them. They may impose a penalty, recoverable in a summary manner, not exceeding £2 for any breach of them by a tenant or occupier. A copy of such bye-laws must, however, be given to each tenant or occupier upon his taking possession, and every bye-law, or alteration, or repeal of bye-laws, must be confirmed by the Secretary of State, in case of houses built in the Metropolis, and by the Local Government Board, in cases of houses elsewhere. Secondly, they may erect lodging houses under the powers given by the Artisans' and Labourers' Lodging-houses Acts, which also will be regulated by bye-laws, and under the control of servants of the local authority. For either of these two purposes they can borrow public money. Thirdly, they may dedicate the whole or any part of the land as a highway or public space; and lastly, they may sell or let the property. In the Metropolis, special conditions, as will be seen, are attached to property so sold; but apparently elsewhere the sale is unconditional, though the consent of a department of Government may in some cases be required. (See 42 & 43 Vict. c. 64, s. 10.)

If, however, the report of the officer of health referred merely to an "obstructive" building, and is followed by

an order of the local authority that it must be pulled down, that order, if not appealed against (or, in case of appeal, if confirmed), authorises the local authority to purchase the lands upon which the obstructive building stands. This they may do any time within a year of making the order, or of its confirmation, if it has been appealed against and confirmed.

When the lands have been so purchased, they are to pull down the obstructive building, or so much of it as is necessary, and to keep an open space sufficient to remedy the evil caused by the old building. The rest they may sell, with the consent of either the Secretary of State or the Local Government Board, according as the premises are in the Metropolis or elsewhere, upon such terms as they think fit. They cannot, however, compel the owner to sell the site if he gives them notice, within a month after their notice of intention to purchase, of his desire to keep it. He may undertake to pull the building down himself, or to allow them to do it, and in either case he will be entitled to receive compensation for the loss of the building; but if he builds or proposes to build upon the site which he has retained, any structure in any way injurious to health, the local authority may make an order for its abatement as a nuisance, or may themselves abate it, and charge him with the expense incurred. The compensation which the owner is to receive for the destruction of his premises, as well as the amount of purchase-money which he is to be paid if he does not elect to retain the site, is to be assessed by an arbitrator in the same way and on the same principles as in the case of uninhabitable dwellings which the owner has called upon the local authority to buy, with this addition, that where, in the opinion of the arbitrator, the demolition of the building increases the value of others not belonging to the owner of the obstructive building, he is to apportion among them so much of the compensation as is equal to the increase of the value of their houses. The amount which each building is thus made liable to pay is "to be deemed to be private improvement expenses incurred by

the local authority in respect of these buildings, and the local authority may, for the purposes of defraying the expenses, make and levy improvement rates on the occupiers of the buildings." * Should the owner or occupier of any adjacent premises alleged by the arbitrator to have been so improved, and assessed accordingly, dispute the fact either of the improvement, or of the amount, two justices are to settle the question in manner provided by section 8 of the Act of 1882.

So far the general effect of the Act is, that the owner of premises dangerous to health so as to be unfit for human habitation, may call upon the local authority to buy, when ordered to repair or demolish them, and the local authority, in the case of obstructive buildings, can call upon the owner to sell. We now return to the case of a notice sent to the owner of premises dangerous to health, so as to be unfit for human habitation, calling on him to repair or demolish them, in order to see what proceedings follow if he does not within the necessary month call on the authority to take them off his hands. Though he does not wish to sell, he need not obey the order in the first instance, as any person whose interest is affected by any order of the local authority is entitled to test its validity by appeal. The appeal lies to the next meeting of justices in quarter sessions, and is conditional upon a month's notice having been previously lodged with the clerk of the local authority, setting out the intention to appeal, with the reasons, and upon satisfactory security having been given for its costs. The decision of this Court concludes the matter, unless either party requests that a case should be stated for the

* "Where an urban sanitary authority has been liable for any expenses which may be declared to be 'private improvement expenses' (*i.e.* causing special benefit to particular persons or premises), a rate called a private improvement rate may be levied on the occupier of the premises, in addition to all other rates, amounting to sufficient to clear off the whole expense, together with interest not exceeding £5 per cent., in any period not more than thirty years. Provision is made for the occupier being allowed to deduct this rate from the rent payable to his landlord." Public Health Act, 1875, ss. 213, 214.

opinion of the High Court of Justice. This request must be acceded to as a matter of right, and transfers the proceedings into the jurisdiction of the Supreme Court. If the appellant is successful, he will get his costs, and the order against him will be dismissed, whereas if the event should go against him he will have to bear the costs of the local authority as well as his own.

Within three calendar months after the service on the owner of any premises of an order requiring works to be executed, or in case the order has been appealed from, within one month of the final judgment, each of the persons served with the notice must signify in writing to the clerk whether he is willing to do the works or not. The owner, however, may elect to take the premises down instead of doing the repairs; it is needless to say that if he does, he is bound to use the site in a manner conducive to the health of the district; and very wide powers are given to the local authority to pull down or alter any building erected in a manner likely to be prejudicial to it. It will be remembered that the expression "owner" has a wider meaning than it bore in the Act relating to nuisances, and that two or three or more persons may well be owners of the same premises. Where two or more signify their willingness to undertake the repairs, he whose ownership "is first or earliest in title" is to be offered the first opportunity of doing them. Sometimes, in the case of a number of owners, the interests of one or more are likely to be prejudiced by the refusal of the others to conform with the local authority's orders; in that case an application to two justices, with proof that the applicant will do what is necessary to put the premises into the required state, will entitle him to an order justifying his entry on the premises, and his execution of the works; his entry otherwise, even to protect his interest, would probably be a trespass, and unlawful. That owner, however, upon whom the duty of doing the works is imposed, must commence, within two months of receiving the order, to execute them in accordance with the plan and specification (*ante* p. 677), and must

complete them to the satisfaction of the surveyor or engineer appointed by the local authority. If he declines, or makes default, the next owner is to be required to do them, and so on in order; but if all make default, the local authority *must* order the closing or demolition of the premises, or may themselves execute the required works. In the latter case there are two ways in which they may be reimbursed their expenses. They may sell the old materials and retain the proceeds, recovering the balance from the owner as an ordinary debt; or they may apply to a Court of Quarter Sessions for an order charging the premises with all the expenses incurred, together with the costs of the order, and interest at five per cent. For the purpose of realising this security, they have all the powers conferred upon mortgagees by 23 & 24 Vict. c. 145, part ii.

When the owner has completed the works, he is entitled, in certain cases, to compensation for his expenditure. He must produce the surveyor's certificate that everything has been done to his satisfaction, and all the accounts and vouchers; and the local authority, when satisfied that the work has been done, must make an order charging the repaired premises with an annuity of £6 upon every £100 of expenditure, payable for a term of thirty years to the owner named in the order, or his representatives or assigns. This annuity takes priority over all existing and future interests or incumbrances in the premises, except quit-rents,* and one or two other specified burdens on the lands; it is recoverable in all respects as if it were a rent-charge granted by deed. Further provisions with regard to this security will be found in § 29 of the Act of 1868 (31 & 32 Vict. c. 130). It is clear that this proviso benefits only the owner with limited interest, as the security from which the annuity is drawn is simply the improved

* "Quit rents, *quieti reditus*, because thereby the tenant was quit and free of all other services: when these payments were received in silver or white money, they were anciently called white rents, *reditus albi*, in contradistinction to rents received in grain or baser money, which were called *reditus nigri*, or black mail."

premises; if the owner's interest in the land were permanent, he would gain nothing by a security over premises already his own.

Proceedings are exactly the same if the order is simply to demolish; the owner must set to work and take the buildings down within the three months; if he fails, the local authority must order the premises to be closed, or do it for him. And, if so, they may sell the old materials and pay themselves, handing over the balance, if any, to the owner. The owner cannot be compelled to demolish a merely "obstructive" building, but only those which, being dangerous to health, are not, in the opinion of the surveyor to the local authority, worth repairing.

Under all circumstances, when the local authority act upon a report of their medical officer, and make an order against a building, they must send notice at once to all tenants residing there, who hold from year to year, or for a shorter time, giving to each one notice of the date when his tenancy will expire.

As regards notices, if the owner upon whom service has to be made resides in the district of a local authority, the clerk must give it to him personally or to some inmate of his house; if he lives outside the district, a registered letter addressed to him is sufficient; and where neither the owner nor his residence can be found, a notice may be served by the clerk leaving it with the occupier of the premises, or, if there is none, by putting it up upon some conspicuous part of them. Any person who obstructs the officer of health, or any other person acting under the authority or orders of the local authority, is liable to a fine not exceeding £20. If, after notice of his intention has been given, the occupier of premises refuses to allow the owner, or if the owner or occupier refuses to allow the officer of health, or any servant of the local authority, to do anything which they are justified in doing under these Acts, complaint should be made to a justice of the peace. He, upon proof that notice has been given, will require the "obstructive" person to admit the officer of health or owner, as the case

may be, to enter the premises and do all that is required of him; and if within ten days this order of the justices is not complied with, a fine of not more than £20 may be imposed for each day's default; but if the occupier alone is responsible for the delay, and the owner is no party to it, the owner is not to be fined.

Whatever expenses the local authority incur in carrying these Acts into execution are to be defrayed out of the local rate. The local rate means the consolidated rate in the City of London; in the Metropolis, a rate to be levied by the vestries or boards of works; and in urban sanitary districts, the rate out of which the general expenses of carrying out the provisions of the Public Health Act are defrayed (see Public Health Act, §§ 207, 211).

For the purpose of providing these funds, the local rate may be increased to the extent of *2d.* in the pound each year, notwithstanding any limit hitherto imposed by any Act of Parliament. And in order to procure money to purchase premises, when called upon, or for certain other purposes, the local authority in the Metropolis may borrow from the Metropolitan Board of Works, and the urban sanitary authorities from the Public Works Loans Commissioners, subject to the following regulations:—

1. The loan must be sanctioned by the Treasury.
2. No loan is to be made except for defraying the cost of building suitable dwellings for the labouring classes, or of purchasing sites and building dwellings on them. The consequences of this restriction is, that wherever the local authority orders the owner of premises unfit for habitation to repair or demolish them, and he calls on the authority to buy, the public money is not to be advanced for the purpose unless artisans' dwellings are reconstructed on the site.
3. The loans are not to carry less than 4 per cent. interest, and are to be secured by a mortgage of the dwellings erected, or proposed to be erected, and of the local rate.
4. All loans are to be paid off in seven years.

5. The sum borrowed is not to exceed the value of the proposed buildings.

Once every year the local authority is bound to make a report, either to the Secretary of State or the Local Government Board, according as the district is metropolitan or urban, giving an account of what has been done, and of all receipts and expenditure in connection with the construction of artisans' dwellings under these Acts.

So far, the provisions we have considered are in force wherever the Acts apply; but in the Acts of 1879 and 1882 (42 & 43 Vict. c. 64; 45 & 46 Vict. c. 54, part ii.), special reference is made to the Metropolis.

The Metropolitan Board of Works exercise a supervision over local authorities in the Metropolis, and may serve a notice upon any one of them, ordering it to put the provisions of these Acts in force. If three months elapse without this order being obeyed, then all the powers of the local authority, so far as relates to the premises included in the notice, pass to the Metropolitan Board, who have power, so far as regards the premises in question, to act in the place of the local authority. Whatever expenses they incur in so doing are payable by the local authority out of the local rates. The circumstances under which the Metropolitan Board of Works will take these steps are either a complaint from a board of guardians, or from an owner of property in the neighbourhood. Whenever an officer of health has reported premises either to be themselves uninhabitable or "obstructive," and the local authority has taken no steps to put the Acts in force, either of the two persons above mentioned may lodge a complaint with the Metropolitan Board of Works, who may thereupon give notice to the local authority to proceed, or may itself in their default do their duty for them at their expense. (It has been noticed that the only circumstance outside the Metropolis where a local authority can be called upon to do its duty, is where four or more householders near a street have called the officer of health's attention to any premises unfit for human habitation, and where the adop-

tion of his report by the local authority has been declined or neglected. These four householders may memorialise the Local Government Board, and ask for an inquiry, and the Board may thereupon verify the grounds of complaint, and call on the local authority to take proceedings.)

The local authorities, or persons to whom they may have let or sold any lands, are to hold the property acquired by them under the Acts in trust, to carry out one or more of the following purposes, "which are to be deemed to be the purposes of the Acts in the Metropolis":—

1. The providing of the labouring classes with suitable dwellings within the jurisdiction of the local authority, by the construction of new buildings, or the improvement of existing ones.
2. The opening out and widening of closed, or partially closed, alleys and courts inhabited by the labouring classes, by pulling down any buildings, or leaving such open spaces as may be necessary to make the alleys or courts healthful.

Subject to this trust, the local authority or lessees may dispose of any premises acquired by them. But if they have kept any for seven years without either selling them or dealing with them effectually in the way of public improvements, they may be sold under the order of the Secretary of State. The proceeds of the sale, after deducting expenses, are to be paid to the local authority, and are to be applied by them for the purpose of improving the health of the district.

Any lessee who acquires land which has come into the possession of the local authority under these Acts is forthwith to proceed, at his own expense, to execute on it the works shown in the plan, or referred to in the specification prepared by them (*ante*, p. 677), or such other works as may have been the matter of agreement between the local authority and himself. These are to be done to the satisfaction of the district surveyor. Should the lessee fail in his opinion to use due diligence, the local authority may enter on the premises and complete the works, repaying

themselves by sale of the old materials, or by an action at law. They acquire, moreover, a charge over the premises to the extent of the claim, to satisfy which the buildings, or any part of them, may be sold. It is also competent to the local authority, when allowing a lessee to acquire the property, to take security from him that he will duly execute the works. Should he, after obtaining possession of the premises, not commence the necessary works within three months, or not complete them to the satisfaction of the surveyor within a year, or such extended time as the local authority may see fit to give him, then the premises and building materials, plant, tools, and other articles, are to be absolutely forfeited, and to vest in the local authority, who are to hold the same for the purposes of these Acts.

Such are the provisions of Torrens's Acts. As was said at page 673 their object is to prevent people living in houses unfit for human habitation, or more exactly, to prevent houses unfit for human habitation from being occupied as dwellings. If their provisions are enforced, the owners of uninhabitable houses *must* be compelled either to repair, demolish, or sell them. The continuation of the houses in their present noxious state is impossible, except in evasion of the Acts, for it is the *duty* of the medical officer to discover their existence and report them, and it is the *duty* of the local authority then to take such steps that they must either be sold, demolished, or repaired. The legal obligation of the owner is to keep his house habitable, and upon his breach of duty a legal obligation devolves upon the local authority to enforce the law. Let us recapitulate briefly, leaving out the machinery by which it is worked, the exact position in which the law places the health authorities. There is the house in a state dangerous to health, so as to be unfit for human habitation. It ought to have been dealt with as a nuisance, and the person responsible for its state should have been summoned, fined, and the nuisance abated. But that has not been done. It might have been closed by order of justices, on the

application of the authority, until rendered habitable. That has not been done. These were the duties of the iocal authority under the Acts which relate to the prevention of nuisances. It is now brought to their notice by a report from the medical officer. It becomes their duty, unless they decide that the report is inaccurate, and that the building is *not* dangerous to health, to make an order upon the owner, calling upon him to do what their surveyor has decided to be necessary, either by reconstruction or demolition of the premises.

One of three things the owner *must* do :—

1. He may obey the order and do the work.

2. He may elect, if ordered to reconstruct, to pull down the building.

3. He may call upon the local authority to buy him out.

In any case permanent improvement must follow if the first step is taken, though the first step unfortunately depends upon the activity of the persons who will have to pay for taking it, as all expenses incurred under the Acts are paid out of the local rate. If the owner does the work, the object of the law is attained, as a habitable dwelling replaces a house unfit for human habitation ; it is always possible, however, that in order to recoup himself the expenditure he may raise the rents, and so make his house uninhabitable so far as regards the class which occupied it when dilapidated. This is a contingency which must be left to the law of supply and demand. If the owner, when ordered to reconstruct, elects to destroy the premises, their removal is a public benefit, though the eviction of the tenants is a hardship to themselves and a probable cause of overcrowding to adjacent houses. There is no restriction as to the manner in which the site is to be employed, so as to ensure the re-housing of as many poor as are displaced ; the owner is free to leave it vacant, or build whatever structure pleases him best, so long as it is nothing prejudicial to the public health. Self-interest guarantees that the site will not be left vacant, and public policy discountenances any interference with the owner's using it in the

manner most beneficial to himself. But the owner may elect to sell, in which case alone the local authority can give the fullest effect to the spirit of the Acts. They may then build dwelling-houses for the poor, in which the number of occupants will be regulated and their behaviour controlled. They *must* do so if they obtain the assistance of public money; they may sell to private persons, binding them to build suitable dwellings, or they may sell unconditionally in certain cases. Wherever a house is found to be unfit for human habitation the owner is under a legal obligation to make it habitable, if it is used as a dwelling; the local authority is under a legal obligation no less imperative to command him to do so, and to see that he does it. That is the first branch of Torrens's Acts. The second is permissive. A house healthy enough and habitable in itself is a cause of others around it being dangerous to health; that gives rise to no legal obligation on the part of the owner to deal with it in any way, but it is none the less essential to the health of the district that it should be removed. The local authority has power to oblige him to sell it, and can then demolish so much of it as necessity requires, and sell or build dwellings upon the land that remains, unless he prefers to retain the site, subject, of course, to an obligation to reconstruct upon it no such building as will be likely to reproduce the evil.

Torrens's Acts were intended to apply, and indeed are adapted only to small improvements, to cases of single houses scattered through a district, or at most to small courts and alleys. For not only has each owner to be individually dealt with in the first instance, but each house has to be made the object of a separate report, and its particular circumstances taken into consideration. Then some owners may elect to sell while others to retain their land, and it is only in the former case that the local authority gets an opportunity of rebuilding. Even then there is no scope for systematic rearrangement or redistribution, as there is no manner of acquiring the necessary lands; the Acts give no power of compulsory purchase

except in the single instance of an obstructive house; and a house that merely stands in the way of improvement, as distinct from health, is not an obstructive building within the technical meaning of the term. But they are applicable (in the City, the Metropolis, and urban sanitary districts) *in every case* of a house dangerous to health so as to be unfit for human habitation, *in every case* of an obstructive building; wherever such are to be found, these Acts may be enforced, and should be enforced, unless the district is in such a state that it falls within the subject-matter of the next chapter.

It is now sixteen years since the first of Torrens's Acts was passed, and five since the amendment under which a local authority could be obliged by the owner to buy his interest. At that time there was a feeling, perhaps misplaced, that the owner of unhealthy premises was harshly treated if obliged to demolish or repair at his own expense, and the law was amended accordingly by enabling him to throw the expense upon the district; since that time it is said that of the vestries and district boards in the Metropolis, twenty-five have not used the Acts at all, and six only to any appreciable extent; that, taken as a whole, they have fallen lamentably short of effecting their object, and that the reason is because local authorities decline to put them in force. Experience, however, showed that the powers given by these Acts, even if adopted, were insufficient to deal with the real evil which haunted the worst parts of great towns. Isolated improvement was seen in many cases to be quite useless where whole areas were unhealthy or diseased, and another series of statutes was consequently passed to deal with wholesale improvement.

IX. Sir Richard Cross's Acts, 1875, 1879, 1882. The Artisans' and Labourers' Dwellings Improvement Acts.

The Act of 1875 sets out in the preamble the evils with which the legislature proposed to deal. It recites that

various portions of many cities and boroughs are so built and the buildings thereon are so densely inhabited as to be highly injurious to the moral and physical welfare of the inhabitants; and that there are, in such portions of the cities and boroughs aforesaid, a great number of houses, courts and alleys which, by reason of the want of light, air, ventilation, or other proper conveniences, or from other causes, are unfit for human habitation; and fevers and disease are constantly generated there, causing death and loss of health, not only in the courts and alleys, but in other parts of such cities and boroughs; and "whereas it often happens that owing to the above circumstances, and to the fact that such houses, courts or alleys are the property of several owners, and it is not in the power of any one owner to make such alterations as are necessary for the public health; and whereas it is necessary for the public health that many of such houses, courts and alleys should be pulled down, and such portions of the said cities and boroughs should be reconstructed; and whereas in connection with the reconstruction of those portions of such cities and boroughs it is expedient that provision be made for dwellings for the working-class who may be displaced in consequence . . ." then follow the enacting clauses.

The localities in which these Acts may be put into operation are the City of London and its liberties, the Metropolis, exclusive of the City and its liberties, and urban sanitary districts containing, according to the last-published census for the time being, not less than 25,000 inhabitants. As in the case of Torrens's Acts, the duty of putting the Act in force is imposed on a local authority, which is, in the City, the Commissioners of Sewers; in the Metropolis, the Metropolitan Board of Works; and in urban sanitary districts, the urban sanitary authority.

The person from whom the initiative in these matters should come is the medical officer of health (see p. 644). It is his duty, whenever he sees cause to do so, to make to his local authority what is called an "official representation." It will be remembered that under Torrens's Acts provision

was made for steps being taken by unofficial persons to put the Act in force ; so here, two or more justices acting within the jurisdiction of the medical officer, or twelve or more persons liable to pay the rates out of which the expenses incurred under these Acts would be paid, may complain to him of the unhealthiness of any area, and he is then bound to inspect it, and to make an official representation setting out the facts, whether in his opinion the area is an unhealthy one or not. Should he fail to do this, or should he make an official representation to the effect that the area is not unhealthy, the ratepayers who signed the requisition may appeal. The appeal lies to what is called under these Acts the confirming authority. It is the Secretary of State, as regards London and the Metropolis, and the Local Government Board in case of other places. To them the ratepayers, upon giving security for costs, may appeal, and they will appoint a medical officer to make an inspection of the area, and to report to them whether he considers it to be an unhealthy area or no. The report which he makes is to be transmitted by the confirming authority to the local authority, and if it is to the effect that the area is an unhealthy one, the local authority must proceed as if it were an official representation duly made to them. The confirming authority has power to deal with the costs, and will in all probability cause them to fall on the ratepayers who have appealed if the appeal is groundless, and on the defaulting local authority if the area was, in fact, unhealthy. In the Metropolis, even fuller provision is made that unhealthy areas may be known and reported ; for, with the assent of the Secretary of State, the Metropolitan Board of Works may appoint one or more legally qualified medical practitioners to carry these Acts into effect in the Metropolis. These officers are to have the same duties as the medical officer of a local authority, *i.e.*, to report whenever they see cause ; but whereas the latter's inspection is confined to the district over which the local authority appointing him had jurisdiction, the former are free to carry their inspection

all over the Metropolis. And any person who obstructs the officer of health, or any other officer of the local or confirming authority in the performance of his duty, is liable to be fined £20 for each offence. Therefore if the medical officer of health is zealous, or if twelve ratepayers in the district take an active part in looking after the state of health of the poorer classes, the local authority ought to know all cases in which unhealthy areas exist in their district. And the Act is definite and liberal in its interpretation of an unhealthy area. Where any houses, courts, or alleys within a certain area under the jurisdiction of a local authority, are unfit for human habitation, or diseases indicating a generally low condition of health amongst the population have been from time to time prevalent in a certain area within the jurisdiction of a local authority, and that prevalence may reasonably be attributed to the closeness, narrowness, and bad arrangement, or to the bad condition of the streets and houses, or groups of houses, within the area, or to the want of light, air, ventilation, or proper conveniences, or to any other sanitary defects, or to one or more of these causes; and the evil connected with the houses, courts, or alleys, and the sanitary defects in the area referred to, cannot be effectually remedied otherwise than by an improvement scheme for the re-arrangement and reconstruction of the streets and houses within the area, or some of them, then *the area is an unhealthy area.*

The official representation (which the medical officer is to make whenever he sees cause), is to set out the cause of unhealthiness, and the local authority are to take it into their consideration. The Act then runs, "and if satisfied of the truth thereof, and of the sufficiency of their resources, they shall pass a resolution to the effect that such an area is an unhealthy area, and that an improvement scheme ought to be made in respect of such an area, and after passing the resolution they shall forthwith proceed to make a scheme for the improvement of the area."

But suppose they do not "forthwith proceed," or decide not to proceed? Express provision is made for such a case.

"Where an official representation is made to the local authority with a view to their passing a resolution in favour of an improvement scheme, and they fail to pass any resolution in relation to the representation, or they pass a resolution to the effect that they will not proceed with the scheme, they must, as soon as possible, send a copy of the official representation, together with the reasons why they have not acted upon it, to the confirming authority (*ante*, p. 694). It is difficult to see for what other purposes than an improvement scheme an official representation would be made. However, the confirming authority are then to hold an inquiry at the place where the alleged unhealthy area exists, and to procure a report as to the truth of the official representation, and any other matters they may desire. The practical effect of this section (§ 8, 38 & 39 Vict. c. 36), is that the Secretary of State, as regards London, and the Local Government Board elsewhere, ought either in one way or the other, to receive information of all unhealthy areas. For if an improvement scheme is set on foot, it is ultimately forwarded to them for confirmation; while if no action is taken on an official representation, a copy of it, and of the reasons why it is disregarded, is to be forwarded to them at once. And it will be remembered that an official representation is not merely made at the caprice of the medical officer; it is his duty to do so whenever he sees cause, and the cause exists whereever there is an unhealthy area.

An improvement scheme, however, is not to be made in the Metropolis where the official representation does not include more than ten houses; in such a case the local authority (the Metropolitan Board of Works) are to order the officer of health to report the case to the local authority under Torrens's Acts, *i.e.*, to the vestry or district board, and it becomes thereupon their duty to put Torrens's Acts in force. That practically comes to this, that in case the area is so small as only to embrace ten houses, it shall be compulsory on the local authority to have the evil redressed, for that portion of Torrens's Acts which deals with

houses dangerous to health is imperative; but when the area is large, whether the evil is redressed or not will depend upon the view which the local authority takes of its resources.

Where, however, the local authority make an improvement scheme, they are not bound to include in it all the land or houses which their medical officer has included in his official representation. On the other hand, they may extend their scheme beyond the area included in it, as it shall appear to them most expedient, in order to carry out satisfactorily the sanitary purposes which they have in view. They should provide, if necessary, as part of their scheme, for widening existing approaches to the district, or for opening it out in any way, so as to make it healthy and wholesome. The scheme must be accompanied by maps, estimates, and particulars, showing what part of the lands included in it are proposed to be taken compulsorily, and must provide for proper sanitary arrangements throughout. It may also provide, if the freeholder of the land agrees, for the whole or part of the scheme being carried out by him under the superintendence of the local authority, and upon such terms and conditions as may be agreed upon between them.

The immediate result of the demolition of such a number of houses (and it will be remembered that in the Metropolis these Acts will not apply to less than ten) is to increase the proportion which the resident population bears to the available accommodation in the district, and at once to produce overcrowding, unless steps are taken to prevent it. Such steps can be taken by the local authority providing suitable dwellings elsewhere, or otherwise; indeed, when the scheme is sent to the confirming authority, it should not be sanctioned unless it is satisfactory upon this point; and the temporary inconvenience imposed on the dislodged inhabitants, who are forced to go elsewhere, must be balanced against the permanent improvement of the whole vicinity. But a far greater hardship would be inflicted on the working classes if no provision was made

for permanently replacing their homes. In the first of Sir Richard Cross's Acts (1875) the local authority, in framing an improvement scheme, was bound to provide in it for the erection of dwellings for at least as many persons of the working class as would be displaced. This was to be within the same area, unless special reasons existed to the contrary , or at any rate in the immediate vicinity. With reference to the feasibility of building dwellings for a much larger number of persons than formerly resided in areas so cleared, a Report made in 1873 states that it is certain that by systematic distribution, by economy of space, and greater elevation of structure, one-half more people might be lodged in a comfortable and wholesome manner, where the present occupants are huddled together in dirt, discomfort, and disease.

It was afterwards considered advisable to modify this requirement, partly because it caused much loss to local authorities, as the sites, when sold for ordinary purposes, realised much larger prices than sites burdened with the restriction of building working people's dwellings, and partly because in many cases equally convenient dwellings for the working classes could be provided elsewhere. It was stated, for example, before a recent Parliamentary Committee, that the cost to the Metropolitan Board of Works, in the case of an unhealthy area, of sites upon which, according to the scheme, artisans' dwellings were to be built, amounted to £2 17*s*. 5*d*. a foot, whereas the advantages of demolition and proper roadways, if the sites might have been sold for commercial purposes, could have been attained at the cost of 13*s*. 10*d*. a foot. The Act of 1879 accordingly amended the preceding Act of 1875 in this particular. It provided that if the local authority could satisfy the authority whose confirmation is necessary before the scheme becomes effective that equally convenient accommodation for any persons of the working classes displaced by an improvement scheme could be provided at some place other than the immediate vicinity, and that such accommodation had been, or was about to be provided, the

confirming authority might permit the scheme. Or if they had already sanctioned a scheme according to which the displaced tenants were to be accommodated in or near the area proposed to be dismantled, and application was made to them to modify it by allowing the local authority to provide houses elsewhere for some of the persons displaced, they might, if it was proved that such houses were equally convenient, permit the modification.

Under either of these Acts, however, it was a condition precedent to the confirmation of an improvement scheme that it should provide accommodation for the same number of persons of the working classes as those whose homes were pulled down, either in or near the same place, or in equally convenient premises elsewhere. The following extract from the Report of the Local Government Board, 1882–1883, shows in a concrete instance the manner in which this requirement worked in practice: "We have during the year confirmed a scheme of the Corporation of Nottingham for the improvement of an unhealthy area in that borough. . . . In confirming that scheme we defined the portion of lands to be included in it which should be taken to represent the unhealthy area, and specified the purpose for which the lands outside such area were included in the scheme. We also required that the part of the Bridge Estate referred to in the scheme should be set aside for the accommodation of the working classes displaced, and that no part of the area to which the scheme related should be cleared of buildings until accommodation had been provided on that estate for those persons."

A further modification of these requirements was made by the last amending Act of 1882. It recognises that it is not always desirable to provide accommodation upon the spot for all the persons displaced, and that it is sometimes better that such portion of them as have no particular necessity to continue in the district should disperse, and find other homes in the suburbs or districts where suitable houses are obtainable; that there should be reconstruction

for those whose business or employment might render their removal from the district a real hardship or loss, but not for those whose dispersion would certainly cause no loss, and perhaps even benefit, both to themselves and the locality. It enacts that where an improvement scheme of a local authority comprises an area situate in the Metropolis or the City of London, the confirming authority shall be authorised (on the application of the local authority, and on a report made by the officer conducting the local inquiry directed to be made by the confirming authority, that it is expedient, having regard to the special circumstances of the locality, and to the number of artisans and others belonging to the labouring classes dwelling within the area, and being employed within a mile thereof, that a modification should be made) to dispense altogether with the obligation of the local authority to provide for the accommodation of the persons of the working class who may be displaced by their scheme to such an extent as the confirming authority may think expedient, but not exceeding *one-half* of the persons so displaced. And where the scheme comprises an area outside London or the Metropolis, the confirming authority may dispense altogether with the obligation to build working people's dwellings in place of those destroyed, without even the restriction to one-half which exists in London. This, if they do at all, they will only do after a satisfactory report from their own officer, sent down into the district to conduct a local inquiry.

This modification very considerably affects the position of the local authorities as explained in the Acts of 1875 and 1879, for it enables the confirming authority in the Metropolis to allow them (if circumstances justify it) to make provision by their scheme for accommodating one-half only of the working classes whom their improvement will displace, while in other places no limit is imposed on the discretion of the confirming authority, and they may pass a scheme which makes no provision at all for re-housing the population which the improvements will render

houseless. It may be noticed in connection with this part of the subject, that by the orders of the House of Commons and House of Lords, the promoters of any Bill which asks for compulsory powers to take land, and which proposes to take fifteen or more houses occupied by tenants or lodgers of the labouring class, are required to deposit statements of the numbers and description of the houses, the number of persons who will be displaced, and to state whether any and what provision has been made for remedying the inconvenience to those persons which the demolition of their houses will create.

When the local authority have drafted their scheme, and provided, as required, maps, particulars and estimates (p. 697), they must advertise in a newspaper circulating within their jurisdiction, for three consecutive weeks during the months of September, October or November, that a scheme has been made, describing the area to which it relates, and naming the place where any person interested may see a copy of it. They must next, in the month following that during which the advertisement has been published, serve a notice upon every owner, or reputed owner, lessee or reputed lessee, and occupier, of any lands which they propose to take compulsorily, so far as they are reasonably able to ascertain those persons, stating that the lands are proposed to be taken compulsorily in furtherance of an improvement scheme, and requiring them to state whether they object to the lands being so taken. This notice must be served (1) by delivery personally, if the person required to be served can be found ; but if he is absent abroad, or cannot be found, then by delivery to his agent, or if no agent can be found, then by leaving it on the premises ; (2) by leaving it at the usual or last known place of abode of the person ; (3) or by forwarding it by post in a prepaid letter addressed to the usual or last known place of abode of the person.

With regard to the occupiers of any house, one notice addressed generally to the occupier or occupiers, and left at the house, is sufficient.

When these requirements have been complied with, the notices duly served and the advertisements published, the local authority are to present a petition to the authority who has power to confirm the scheme, praying that an order may be made confirming it. The confirming authority for the City of London and the Metropolis is one of the principal Secretaries of State; for urban sanitary districts, the Local Government Board. This petition must be accompanied by a copy of the scheme; it must state the names of all owners or reputed owners, lessees or reputed lessees, who have signified their dissent to the taking of their lands, and it must be supported by such evidence as the confirming authority may think proper to require.

The confirming authority will take the petition into consideration, on proof of the publication of the advertisement, and the services of the notices; it may, however, dispense with the publication, or the service of notices where reasonable cause is shown why such dispensation should be granted. This concession may be conditional upon other advertisements or notices being published again elsewhere, or may be unconditional; but due care is to be taken that no person's interest is prejudiced by such dispensation.

If the confirming authority think fit to proceed with the scheme, the next step is to direct a local inquiry to be held in the district to which the scheme relates, for the purpose of ascertaining whether the official representation is correct, whether the scheme proposed is sufficient to meet its object, and whether any and what local objections are entertained to its being carried out. That is done by the confirming authority sending an officer to the place of the proposed improvement, whose duty it is to ascertain the requirements and feeling of the district. He is not to commence until he has made public, by advertisement or other means best calculated to attract the notice of the persons residing in the area, his intention to make the inquiry, and the time and place where he will attend to

hear all persons who may be desirous to be heard before him upon the matters into which he is instructed to inquire. This officer is entitled to administer an oath to persons appearing before him, and when he has concluded his inspection and inquiry, it is his duty to embody it in a report to be forwarded to the confirming authority.

Upon receipt of this report, the confirming authority may make a provisional order, declaring the limits of the area to which the scheme relates, and authorising the scheme to be carried into execution. This provisional order may either be made absolutely—*i.e.*, in exact accordance with the scheme as proposed by the local authority—or subject to what modifications and conditions the confirming authority think proper to make, always provided that no addition is to be made by them to the lands proposed in the scheme to be taken compulsorily. This provisional order is then to be transmitted to the local authority, and by them copies of it must be served upon all persons on whom notice of the proposal to take lands compulsorily was directed to be served, and in similar manner, except that no notice need be served on tenants holding on terms of a month or less. Nothing now remains to be done but to procure the confirmation by Parliament of the provisional order, and this the confirming authority—*i.e.*, the Secretary of State or Local Government Board—may obtain. Parliament may of course modify it in such manner as they may deem fit, and the provisional order, having received Parliamentary sanction, is to be deemed a Public General Act of Parliament.

It has been pointed out that the scheme must particularly indicate those lands which the local authority propose to take against the will of their owners. These owners, if they have opposed the scheme and incurred costs in so doing, may have the costs allowed them if, in the discretion of the confirming authority, the opposition was justified. The costs, together with such as the confirming authority may have incurred, in relation to the provisional order, are to be paid by the local authority promoting the scheme,

in such manner and with such interest under 5 per cent. as the confirming authority may direct. Persons opposed to the scheme may carry their opposition even further, by petitioning Parliament to refer the provisional order to a committee, who have power to deal with the costs incurred before them, according as they think the action of the petitioners justified or not.

When the scheme has thus become law, it rests with the local authority to carry it out. First they have to purchase the land required for it, which they have power to do compulsorily under their Act. This land they may sell or let to any person who will bind himself to lay it out as the scheme proposes. In particular they may restrict such person in the class of buildings to be erected, and make his keeping possession of the land conditional on his properly repairing and maintaining them. It is clear that the value which these sites will fetch in the market must very much depend upon the discretion showed by the local authority in the covenants with which they burden them. The main object to keep in view, is to prevent the district now reformed from ever falling into its late condition; but it is essential also, if the Acts are ever to work practically, that the local authority should be as little a loser, in a pecuniary point of view, as possible. The more favourable conditions, therefore, which the local authority is prepared to grant to its lessees or purchasers, consistently with the health of the district, the more probable that the real intention of the Act will be carried out. They may also enter into contracts with any body of trustees, or any society, or person, to carry out the whole or any part of the scheme, upon such terms as they think expedient; and, as has been already noticed, another Act of Parliament provides that the Public Works Loans Commissioners may lend to any such company, society, or association, established for the purpose of constructing or improving dwellings for the labouring classes, any sum or sums to be applied in building dwellings suitable for the labouring classes, or towards the purchase of lands

for that object, such loans to be repaid with interest at not less than 3½ per cent. in fifteen years.

The local authority themselves are prohibited from undertaking, without the express approval of the confirming authority, the rebuilding of any houses, or the execution of any part of the scheme, further than clearing the area by taking down the buildings. As regards this, it is specially provided that not less than thirteen weeks before taking any fifteen houses or more they are to make known their intention of taking them by handbills or placards put up in view of or close by the houses; and they are to obtain from a justice, before taking the premises, a certificate that it has been proved to his satisfaction that the intention has so been made known. They may, however, also lay out, pave, and drain, such streets as they may think fit to form. The expense of repairing these streets when formed is to fall upon the authority who has charge of the public streets in the district.

With regard to the parts of the land which the local authority has let or sold, it will be remembered that they *may* impose conditions as to buildings, &c.; but as to so much of the area as was by the scheme to be appropriated to labourers' dwellings, they *must* impose suitable conditions and restrictions as to their design, accommodation, elevation, and size, and they *must* make due provision for the maintenance of proper sanitary arrangements therein.

If the local authority have built any dwellings themselves, with money borrowed under powers given by these Acts, they are not to keep them longer than ten years without procuring the sanction of the confirming authority. The local authority, if it has built, has probably done so on the area cleared, by the express permission of the confirming authority, or on lands of their own elsewhere, for the purpose of providing accommodation for tenants displaced by their improvements. It is not necessary for the local authority to buy the land occupied by the unhealthy area, if the scheme can be worked without it.

they may, although the provisional order when confirmed by Parliament, gives them powers of compulsory purchase, agree with the person entitled to the first estate of freehold that he shall carry it out.

It is clear that a limit must be set to the time during which the land thus cleared may be left unbuilt upon, so far, at any rate as the policy of the Acts is to provide for rebuilding of artisans' dwellings; five years is the time fixed within which active steps must begin to be taken. If within five years after the land has been cleared, which in the provisional order was set aside for working-men's dwellings, the local authority have found nobody willing to buy or take it on lease for that purpose, and have failed to enter into arrangements for the erection of dwellings in accordance with the scheme and the provisional order, the confirming authority may order it to be sold. In doing so they may modify the scheme, and add any further regulations or terms; but the land must be taken on the express condition that the purchaser shall erect working-men's dwellings thereon in accordance with plans to be approved by the local authority.

After a provisional order has been confirmed by Parliament, and has thereupon become law, it may still to a certain extent be modified by the confirming authority. The local authority may prove to them that the details of the scheme can be improved, or that it is expedient to make different provisions with regard to replacing the houses of artisans displaced, than was included in the scheme as originally framed. It has been already noticed what the duties of the local authority are in that particular, and if they can satisfy the confirming authority that the change is beneficial, it may be agreed to. Even in this case, a statement of the modifications permitted must be laid before Parliament as soon as practicable by the confirming authority; while if the proposed amendments will involve a larger public expenditure, or the compulsory taking of fresh lands, or any injury to property which was not included in the original scheme, the whole process must

be gone through again, by a new provisional order being made, and fresh Parliamentary sanction being formally obtained.

As regards the taking of lands, the local authority may agree with the owners to purchase whatever may be necessary for the furtherance of the scheme, as authorised by the confirming Act; but they are only entitled to force the owners to sell such lands as were expressly mentioned in the confirming Act as about to be compulsorily taken. In this latter case the important question arises as to the compensation which the owner is to receive. It is to be settled by arbitration, and the principle on which it is assessed is the same as is applied to valuations under Torrens's Acts. No allowance is to be made, if the land is part of an unhealthy area, for the compulsory purchase. As a rule the person obliged to sell is entitled to an extra 10 per cent. The estimate is to be based on the fair market value at the time the valuation is made, due regard being had to the nature and then condition of the property, and the probable duration of the buildings in their existing state, and to their present state of repair. No addition to, or improvement of, the property made after the publication of the advertisement that a scheme has been framed shall be allowed for, unless such addition or improvement was necessary for maintaining the premises in proper repair; nor in the case of any interest acquired after that date is a separate valuation to be made so as to increase the total amount payable. The amending Act of 1879 modified the principle on which compensation is to be adjusted by providing that if the arbitrator in assessing compensation is satisfied that a house or premises was a nuisance within the meaning of the Acts relating to nuisances, at some date between that of the official representation and of the confirming Act, he shall determine what would have been the value of such house or premises supposing the nuisance had been abated, and what would have been the expense of abating it; and the amount payable to the owner shall be equal to the value of the house after the nuisance has

been abated, and less the cost of abating it. An illustration of how this principle applies may be taken from a letter of the Metropolitan Board of Works to the Home Office, dated August 1, 1879, in which it was stated that "an instance occurred . . . in which if the consideration that the property was in such a condition as to endanger public health had been acted upon (and it was admittedly true) the property would have been valued at £500, whereas compensation was given under the arbitrator's award to the extent of £3,500." A special committee of the Charity Organization Society (in 1880) report that "in their opinion this principle should be carried further, and that where property has been allowed to fall into a disgracefully bad, unhealthy, or overcrowded state, and requires reconstruction, the local authority on the owner's neglect of notice to rebuild should have power to demolish, and to compensate only for the value of the land and the materials." To some extent this has been adopted in the rule acted upon by arbitrators in treating a house which is in such a state as to be unfit for habitation and past repair, as nothing but a site with a few cart-loads of building materials upon it.

The power of the local authority to buy the lands mentioned in the provisional order as to be compulsorily taken must be exercised within three years after the passing of the confirming Act.

It frequently happens that land which the local authority are desirous of buying for the purpose of their scheme is burdened with what is called an easement. An easement may be roughly described as a right of property which exists over the land in favour of some person other than the owner of the land, as, for instance, a right of way, or a right to lay down pipes or drains below the surface of the soil. These rights are valuable property, and as provision is made for their extinction, and for the passing of any pipes, drains, or similar plant, to the local authority, compensation must be made to the persons who sustain any loss thereby.

Then with regard to the expense of working these Acts.

The local authority must keep a separate account of receipts and expenditure, care being taken, so far as possible, that all expenditure shall ultimately be defrayed out of the property acquired by them under the Acts. Provision is made for these accounts being duly audited. Their receipts are to form a fund (the "Dwelling-House Improvement Fund"), out of which their expenditure is to be made. Into this fund may be brought any money, or the produce of any property, which the authority is entitled to apply to purposes similar to those contemplated by the Acts; and if there is any doubt with regard to any case, whether or not money may be so used, or property so applied, the confirming authority have absolute power to decide the question. The moneys required in the first instance to establish the fund, and any deficiency caused by excess of expenditure over receipts, are to be made up,

(1.) Out of the local rates.

The local rates in the City of London mean the sewer rates or the consolidated rate leviable by the Commissioners of Sewers, or either of them; in an urban sanitary district, the rates out of which the general purposes of the Public Health Act are defrayed, while in the Metropolis the Metropolitan Board of Works are to levy as part of the consolidated rate a sufficient amount for the purposes of these Acts.

It will be remembered that to meet the expenses of Torrens's Acts the rates might only be increased to the extent of *2d.* in the pound; in the present case they may be indefinitely increased, notwithstanding any limit hitherto imposed by any Act of Parliament.

(2.) Out of money borrowed in pursuance of these Acts.

For the purpose of carrying out their improvement scheme the local authority may borrow on the security of any houses or property acquired by them, and may mortgage it accordingly. The interest on the loan is to be paid out of the local rates. Should they require more money than their property will cover as security, they may raise it in the following manner :—

a. An urban sanitary authority, or the Commissioners of Sewers, may pledge the local rate.

b. The Metropolitan Board of Works may, with the consent of the Treasury, create consolidated stock (under powers given by an Act of Parliament of 1869), and pay the dividends out of the consolidated rate. But each vestry or district board in the Metropolis will be called upon to repay to the consolidated rate the amount which has been expended in respect of its particular parish or district.

If the local authorities are unable to procure the money so required from private sources, the Public Works Loans Commissioners may, with the consent of the Treasury, advance to them any sums necessary for carrying out the purposes of these Acts, upon the securities before alluded to. Any such loan must be repaid within fifty years, or such shorter time as the confirming authority may recommend, and is to bear interest at the rate of $3\frac{1}{2}$ per cent. per annum, or so much more as may be necessary to enable the loan to be made without loss to the exchequer.

X. Provisions of Sir R. Cross's Act with regard to Compulsory Purchase.

There only remain to be noticed the provisions annexed to these Acts with regard to the compulsory purchase of lands. It will be remembered that when the scheme was being prepared, notice was to be sent to all owners or reputed owners, lessees or reputed lessees, asking them whether they objected to their interests being taken; and such of them as objected were to be specially mentioned in the scheme as submitted to the confirming authority. When the Act is passed, making the provisional order law, the local authorities are armed with compulsory powers to buy these persons out; these powers lapse after three years. As soon, therefore, as practicable, they must make out plans and schedules of such lands or houses, with the names of all persons interested in them annexed; these

plans and schedules are to be signed by the clerk, and to be deposited with the confirming authority, copies being kept by the local authority at their offices. If the compensation to be paid to these owners, or to persons whose interests the scheme injuriously affects, cannot be amicably settled, the local authority must apply to the confirming authority, requesting them to appoint an arbitrator. On his appointment the arbitrator, after making a statutory declaration faithfully to perform his trust, has delivered to him by the confirming authority the maps and schedules signed by the local authority's clerk. Public notice has then to be given of the arbitrator's appointment, and of the place where any person interested may inspect the copy of the plan or schedules; this notice is to be given not merely by advertisement in newspapers, but by placards being posted on or near the lands to be taken, by leaving a notice at each of the houses on the land, and by sending a notice by post to the reputed address of every person interested. The arbitrator then inquires from the local authority the amount they are willing to pay, and from the claimant the amount which he considers he is entitled to receive, hears the evidence, and proceeds to make his award. Under the first of these Acts (1875) the first award was only provisional, as every claimant could object to the amount, and have his case gone into again. When these objections had been heard the final award was made, and deposited with the confirming authority, a copy being sent to the local authority: if the amount of compensation awarded exceeded £500, either party being at liberty to appeal to a jury. The provisional award had no such effect as to pass the property out of the owner, or to free him from his obligations in respect of it. Thus in the case of *Barnet* v. *The Metropolitan Board of Works* (46 L. T. 585), the appellant was the owner of some houses included in an improvement scheme, and proposed to be taken under compulsory powers. An arbitrator was appointed, and made his provisional award on March 18th, his final award on July 22nd. On July 16th the Metropolitan

Board of Works, who had repeatedly given notice to the owner to hoard the premises, which were in a ruinous and dangerous state, incurred an expense of £78 in making them safe in the owner's default. To an action in which they sought to recover this amount it was pleaded that, inasmuch as the expense was incurred after the provisional award, the appellant was under no liability to pay for repairs executed after the ownership had ceased, but the Court held that there was no transfer of ownership until the final award was made. The last Act (1882) somewhat shortens proceedings by doing away with the provisional award altogether, and making the first award final and conclusive, subject to appeal to a jury. This appeal only lies, however, where the amount awarded exceeds £1000. The costs will be allowed to the successful party on appeal, and the arbitrator may allow the complainant his costs incurred at the reference, provided the amount awarded exceeds the amount of the offer made by the local authority before proceedings commenced.

Further information as to the proceedings before the arbitrator, and matters incident to his award, the payment, and the transfer of the property, are to be found in the schedules of the Artisans' and Labourers' Dwellings Improvement Acts, 1875 and 1882.

Such are the provisions of Sir Richard Cross's Acts, under which unhealthy areas may be demolished and rebuilt. Compared with Torrens's Acts, they differ in degree only, and not in kind; both have the same object, to pull down uninhabitable and insanitary houses, the one dealing with single structures or small areas, the other with masses of buildings or extensive districts. They proceed by different methods; the one calls on the owner, in the first instance, to make his premises habitable, and compels him to do so unless he elects to sell; the other forces the owner to sell, and provides for rebuilding on a systematic plan.

A report published in August, 1883, gives a statistical account of the working of the Acts from the time of the

original Act in 1875 until the end of December, 1882 There are ninety-four urban sanitary districts where no steps whatever have been taken under them. There are ten in which provisional orders have been issued, and six where the Acts are under consideration. In the City of London there have been two official representations, one in October, 1875, and one in June, 1879; but the improvement scheme which relates to the latter is in abeyance. In the Metropolis there have been thirty-three official representations. Of these ten have been rejected by the Metropolitan Board of Works, on the ground "of the limited size of the area." Now the limits which Parliament considered as justifying non-intervention was ten houses; for it will be remembered that when an official representation (in the Metropolis) related to not more than ten houses, the medical officer was to be ordered to refer the matter to the local authorities under Torrens's Acts. Of these areas rejected on account of their size, one contains twenty-five, and another thirty-eight houses; the others vary from twenty-five down to six; so it is apparent that the Metropolitan Board of Works considers itself at liberty to decline to act upon an official representation, even though it extends to an area considerably larger than that which the Act of Parliament defines as of the minimum size to which it is applicable. Of the sites cleared by the Board, six have been bought by the Peabody trustees; upon five of them the buildings are completed and inhabited, and on the sixth they are in course of erection.

The same report contains a correspondence which is interesting, as furnishing a concrete instance of the manner in which Sir R. Cross's Acts have been attempted to be applied. It will he remembered that any twelve or more ratepayers, in any urban sanitary district of the size requisite to permit of the application of the Acts, can address a memorandum to the medical officer of health, calling on him to make a report upon any buildings which they consider dangerous to health, so as to be unfit for human habitation.

On the 22nd of July, 1882, twelve ratepayers of Dover

addressed such a requisition to the medical officer of health for that borough. On the 1st of August the medical officer sent in his report to the Town Council, in which he decided that the premises—eight houses—formed an unhealthy area, and that the evils connected with the houses and their sanitary defects could not be remedied otherwise than by an improvement scheme for their re-arrangement and reconstruction. It was then found that the property was owned by the Dover Harbour Board, and, at the proposal of the Town Clerk, copies of the complaint and representation were forwarded to them, requesting them to inform the sanitary authority whether they were prepared so to deal with the property as to obviate the necessity of any further action. This, apparently, the owners declined to do. On the 22nd of August the Town Clerk laid before the managing committee of the sanitary authority a statement of the legal and financial bearings of the proceedings in relation to these houses. He pointed out that the twelve ratepayers were within the law in making their complaint to the medical officer, and that the Act had been duly complied with ; he then sketched the proceedings which were required to follow, pointing out that if the Council failed to pass a resolution, or passed one to the effect that they would not proceed, they would be bound to send a copy of the resolution and their reasons for adopting it, to the Local Government Board, who might direct a local inquiry to be held.

He pointed out that the expenses would be very heavy; that the borough would have to bear the cost of any opposition to the scheme, or to the provisional order in Parliament, as well as the expenses of the Local Government Board, in relation to the order. That they would have to purchase the freehold and leasehold interests, to compensate any person injuriously affected, and perhaps to pay the expenses of arbitration and appeals from the award.

These considerations of expense, when the small size of the area was taken into account, made it unadvisable, in his opinion, to apply Sir Richard Cross's Acts. He therefore

pointed out that two other courses were open to the sanitary authority.

1. To proceed under Torrens's Acts.

If they decided to do so, they would have to determine whether the buildings were unsanitary or merely obstructive, and would have to make orders for their demolition and reconstruction, buying from the owner, if he forced them to do so, and compensating him if obstructive houses were pulled down. These proceedings would be less expensive than the original scheme, as the costs of preliminary steps are far less, and as no leaseholder who has a shorter interest than twenty-one years is entitled to compensation.

2. To proceed under the Acts for the prevention of nuisances, if the health officer's report would bring the buildings within the definition.

In this way the evil would be inexpensively met, as the justices might make an order prohibiting the use of the premises as dwellings until rendered fit for human habitation.

On September 8th the Sanitary Authority resolved that it was not satisfied with the correctness of the official representation, or of the sufficiency of their resources, and it declined to make an improvement scheme. The Town Clerk was thereupon ordered to send a copy of the documents to the Local Government Board, and the medical officer of health was directed to ascertain whether the houses, or any of them, were a nuisance. On September 21st the Local Government Board desired to be informed what steps the Dover sanitary authority proposed to take, since it had declined to entertain the improvement scheme, and the authority answered that they had directed their officer of health to ascertain whether the houses were a nuisance. A second application of the Local Government Board, on November 16th, to the same effect, was met by an inquiry from the sanitary authority as to what right the Local Government Board had to interfere. The Local Government Board justified their inquiry under their powers to direct a local inquiry, stating that they required

the information in order to arrive at a conclusion whether a local inquiry ought, under the circumstances, to be directed. At this point the published correspondence ceases, leaving it doubtful what steps, if any, were taken to remedy the evils which the medical officer had, on the 1st of August, certified could only be met by reconstruction and rearrangement of the houses; but its tenor leaves no room for doubt that the sanitary authority were averse to the expense of proceeding under either of the sets of Acts of Parliament which provide for reconstruction, though prepared to take steps to compel the owner to abate the nuisance. It probably is not unfair to assume that one sanitary authority resembles another at least in this, in its extreme distaste to increase the total burdens, and that the reason why Torrens's Acts have been a failure, and why Sir Richard Cross's Acts have been grudgingly set in motion, why the Artisans' and Labourers' Lodging-House Acts have only once been taken advantage of, is simply the fear of expense. Assume that the Dover sanitary authority called upon the owners of those houses to abate any nuisance there might be in them; assume even that an order was made prohibiting their use until rendered habitable. If the medical officer's report was correct, nothing short of reconstruction and re-arrangement was adequate to meet the evil, and this the owners could not, under the Nuisances Acts, be obliged to do. In plain terms, the sanitary authority either cannot, or will not, undertake the cost. The same reason, beyond doubt, applies to the areas which, in the last Parliamentary return, were passed over on account of their not being of sufficient size. They were of sufficient size to attract the attention of the officer of health, and in his opinion to require, in the interest of the public health, to be demolished and rebuilt, but not of sufficient size to justify the interference of the Board of Works. The interference of the sanitary authority is, under § 3 of the Act of 1875, compulsory if they are satisfied of the truth of their officer's statement, and of the sufficiency of their resources. It is scarcely probable that

the officer of health would make his representation on insufficient grounds, or that the sanitary authority would fail to verify his report if they saw reason to doubt its truth; they must decline to act under the alternative, viz., insufficient resources. Possibly what is meant by saying that the area is too limited in size is, that the expenses of the Act would, except in cases of districts of substantial size, be disproportionate to the benefit which would arise from reconstruction; if that is so, it is a good reason why the Act should be modified to meet such cases, or why it should be made compulsory to enforce Torrens's Acts wherever an official representation was rejected on these grounds. It is enough, however, for our present purpose if we remember that the urban sanitary authority or local authority has the fullest power to rearrange and reconstruct whenever the necessity for it exists, provided it is willing to meet the inevitable expense.

CONCLUSION.

It only remains to summarise in a few words the matter of the preceding pages. It would appear that there are four classes of persons on whom legal obligations with regard to the dwellings of the poor either rest, or might be made to rest, under the existing law.

1. The poor themselves. There is a tendency to treat of them as if they were utterly irresponsible for their own state, as if their condition was attributable solely to the neglect or avarice of landlords, and to the apathy of local authorities. No doubt the latter are very much to blame, the landlord for permitting the state of things in the first instance, and the local authority for not detecting and stopping it. But the obligation not to *cause* or *permit* a house to be overcrowded presses legally with equal force upon those who overcrowd, and those by whose permission it is done. The obligation not to cause a dwelling to be injurious to health affects its occupants no less than its owner; and though proceedings against the wretched

inmates may scarcely be worth serious consideration, the existence of the obligation should not pass unnoticed.

There are, however, duties of another nature, which may be laid on certain classes of the poor. The bye-laws for the discipline of houses let in lodgings, or occupied by members of more than one family, create legal obligations binding upon all persons who occupy such houses; and such obligations, if judiciously imposed and rigidly enforced, would effectually deal with practically all the evils which have been hitherto engendered by the habits and conduct of the poor themselves. Whether the further extension of these powers by the legislature is desirable, so as to embrace all houses occupied by the poorer classes, whether as lodgers or not, will be a matter for consideration when there has been opportunity for observing how they work in practice. At present it is only a few months since the vestries and district boards of London have received their powers, and even assuming they have made use of them, it is too soon to look for substantial results. But as the system has been working most successfully in common lodging-houses for the last thirty years, it is confidently hoped that the improvement in the condition of the houses subjected to it will be anything but inconsiderable.

2. The immediate landlords of the poor (not being owners of the premises). Their obligations are in no way different from those of the poor themselves. If they *cause* or *permit* the existence of a nuisance, they are liable for their breach of duty; if their house, or any part of it, is occupied by members of more than one family, the bye-laws just alluded to will impose upon them duties as regards the numbers they may accommodate, the manner in which they are to be lodged, and the maintenance of cleanliness and order throughout the house.

3. The owners of premises. These are liable, if the premises are occupied as dwellings, for their structural condition. They may be ordered, and should be ordered, to put them into a sanitary state if they are injurious to health, to repair or demolish them if uninhabitable, to sell

them if obstructive, or necessary for the completion of an improvement scheme.

4. The local authorities and their officers, whose duty it is to enforce the law.

It is with these last, under our present system, that it rests to decide whether the law shall be a dead letter or a practical reality ; and though, as it stands at present, it is possible that there are evils in connection with the homes of the poor, which the law is not comprehensive enough to meet, it is undeniable that every overcrowded, every unhealthy dwelling, exists in violation of the law which it is the duty of the local authority to enforce, and that every unhealthy area, every obstructive house, testifies, in the absence of evidence to the contrary, the neglect of local authorities to avail themselves of their powers.

SCHOOLS OF ART:

THEIR ORIGIN, HISTORY, WORK, AND INFLUENCE.

BY

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"The excellence of every art must consist in the complete accomplishment of its purpose. . . . Nothing has its proper lustre but in its proper place."—SIR JOSHUA REYNOLDS.

PREFACE.

THE circumstances by which I found myself surrounded when I undertook to write this Handbook, rendered it impossible that I could do more than devise a plan, indicate facts and the sources from which they could be derived, control the form of the work, and be responsible for all statements and opinions that it contains.

The real labour that the book entailed has been borne by my friend Mr. Francis Ford, to whose literary taste the work owes all that it possesses in style and clearness.

JOHN C. L. SPARKES.

July 9, 1884.

SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION, SOUTH KENSINGTON.

Established in connection with the Board of Trade in March, 1853, as a development of the Department of Practical Art, which in 1852 had been created for the reorganization of Schools of Design. Nominally placed under the direction of the Committee of Council on Education in 1856, and transferred from the Board of Trade in February, 1857.

List of Presidents, Vice-Presidents, Secretaries, and Chief Executive Officers.

Board of Trade.

1852. Rt. Hon. H. Labouchere, M.P.
Rt. Hon. J. W. Henley, M.P.
1853. Rt. Hon. Edward Cardwell, M.P.
1855. Rt. Hon. Lord Stanley of Alderley.

During the above years Mr. Cole, C.B., was the chief executive officer under the successive titles of General Superintendent, Joint Secretary and Inspector, and General Inspector.

Committee of Council on Education.

Years.	Lord-Presidents.	Vice-Presidents.	Secretaries.	Assistant-Secretaries.
1856–57	Rt. Hon. Earl Granville, K.G.	Rt. Hon. W. E. Cowper, M.P.		
1858	Most Hon. Marquess of Salisbury.	Rt. Hon. Sir C. B. Adderley, K.C.M.G., M.P.		
1859–63	Rt. Hon. Earl Granville, K.G.	Rt. Hon. Robert Lowe, M.P.		
1864–65	Ditto.	Rt. Hon. H. A. Bruce, M.P.	Mr. Cole, C.B.	
1866	His Grace the Duke of Buckingham and Chandos.	Rt. Hon. H. T. Lowry Corry, M.P.		
1867	His Grace the Duke of Marlborough, K.G.	Rt. Hon. Lord Robert Montagu, M.P.		
1868–72	Most. Hon. the Marquess of Ripon, K.G.	Rt. Hon. W. E. Forster, M.P.		
1873	Rt. Hon. Lord Aberdare.	Rt. Hon. W. E. Forster, M.P.		
1874–77	His Grace the Duke of Richmond and Gordon, K.G.	Rt. Hon. Viscount Sandon, M.P.		Mr. MacLeod.
1878–79	Ditto.	Rt. Hon. Lord George Hamilton, M.P.	Sir Francis Sandford, K.C.B.	
1880	The Earl Spencer, K.G.	Rt. Hon. A. J. Mundella, M.P.		
1881–82	Ditto.	Ditto.		Col. Donnelly, R
1883	Rt. Hon. Lord Carlingford, K.P.	Ditto.		
1884	Ditto.	Ditto.	Col. Donnelly, R.E.	

PRINCIPAL AUTHORITIES CONSULTED.

Report of Select Committee of the House of Commons, and Evidence	1835–6
Report on Foreign Schools of Design, by W. Dyce, R.A. .	1840
Report of Select Committee appointed to take into consideration the Promotion of the Fine Arts, in connection with the rebuilding of the Houses of Parliament .	1841
Reports of the Council of the School of Design, and of Special Committees of the Council	1841–7
Report of the Select Committee of the House of Commons, and Evidence, and Draft Report proposed by the Chairman (Mr. Milner Gibson)	1849
Reports of Mr. Ambrose Poynter, Inspector of Branch Schools	1850–1
Letters of the Joint Head Masters of the School at Somerset House	1850–1
Annual Reports of the Department of Science and Art .	1854–83
Report of Select Committee of the House of Commons, and Evidence	1864
Colonel Donnelly's 'History of the Science and Art Department,' published in the 30th Report of the Department	1883
Art Directory, revised to 1883	1883
Special Descriptive Catalogues and Handbooks of the South Kensington Museum.	

CONTENTS.

SCHOOLS OF ART:

THEIR ORIGIN, HISTORY, WORK, AND INFLUENCE.

CHAPTER I.

NATIONAL ART TENDENCIES IN THE PAST.

IN a treatise professing to deal with the history, work, aims, and influences of our national Schools of Art—or, as they were originally called, Schools of Design—it is desirable, as a preliminary step, to consider the evidence afforded by our past history as to the artistic faculties and tendencies of the English people, for it is upon these that the cultivation of artistic taste and progressive excellence in art-manufacture must be dependent.

Until within a comparatively recent period, it was, with many, an accepted dogma that the productions of our handicraftsmen had never had but one meritorious characteristic, good solid workmanship; that we were, and always had been, lamentably deficient in artistic capacity; that in all matters of taste the dictum of our Continental neighbours, and especially of those who are nearest to us on the opposite side of the Channel, should be deferentially regarded as conclusive; in short, that the beneficent influences of artistic culture, like the soft breezes of less rigorous climes, were wafted to these islands from the sunny South. It was urged that English art was substantially foreign art; that our early architecture came from Normandy, our pointed Gothic from France, our painting from Flanders, our

costume from Italy, and so forth; and in a sense this might be true. But it might with equal force be objected that Greece obtained her art from the East, and Rome from Greece, and France from Rome, without giving to each the credit which we claim for ourselves—that having had the judgment to import what suited our tastes and requirements, we had also the skill so to modify the importation that it became essentially our own, with distinct national characteristics.

It will therefore be satisfactory to show, in the first place, that, in the best and truest sense, England has always been an artistic country; that the arts of architecture and of applied design—to employ a modern expression which covers a great deal of ground—flourished here throughout the Middle Ages; that although there was a subsequent period of decadence, this has been followed in more modern times by a revival of artistic excellence, fostered and developed by the Art Schools established and encouraged by successive Administrations during the last half-century; and that in our application of art to industrial purposes—to say nothing of those higher branches with which it is not proposed to deal here—we are at the present moment in the foremost rank amongst the nations of Europe. Not that all this has been effected of a set purpose, in obedience to the dictates of a well-digested scheme, but rather—like many of our national successes—in spite of much blundering, subject always to the best of corrective influences, the sound practical common-sense of an intelligent, persistent, and determined people. There is, indeed, no reason why this nation should not in the future—perhaps in the immediate future—become as renowned for artistic taste, as it has been in the past for substantial excellence, in all manufactures dependent on the cultivation of the arts of design. It is, however, desirable, when contemplating such advance on the one hand, to beware of decadence on the other; to be careful lest we lose the reputation (somewhat imperilled by inferior workmanship in recent times) to which our productions have owed pre-eminence in that important particular. The assurance that an article was of English

make was at one time a sufficient guarantee of mechanical excellence, if not of tastefulness in form or decoration ; let us beware lest, in attaining what we lacked, we imperil that which all the world was ready to acknowledge as our own.

It is, indeed, difficult to imagine on what ground any civilized people could be charged with such a deficiency of artistic capacity as that which it was at one time the fashion to attribute to ourselves, we might even say with our tacit acquiescence. In every portion of the habitable globe evidences have been found of artistic tendencies, which, indeed, appear to be instinctive. Even among savage tribes, the common implements and utensils of domestic use, of the chase, of warfare, are found, first, to be adapted by their construction to the special purposes for which they are designed, and then to receive such modifications of form as may render them pleasing to the eye, and such ornamentation as the fancy may suggest. And in the earliest of these stages we find artistic instinct in the exercise of one of its most important functions. As in nature, so in art, utility and beauty go hand in hand ; and when an implement is found to be fully adapted to its purpose, admirable in its completeness, without anything superfluous or incongruous in its construction, we have the beauty of utility, or, as Mr. Poynter terms it, "the beauty of fitness"—a kind of beauty that cannot be too persistently kept before the mind of the workman. It has been too much the fashion to regard beauty and utility as distinct things, if not actually antagonistic, at least independent the one of the other ; but this is a fallacy controverted by all good workmanship, viewed in an artistic light. Even in the primitive work of savage tribes, in their spontaneous efforts to impart grace of form and ornament to what was in the first instance constructed simply for convenient use, may be found the germs of artistic feeling—a tendency to practical art as a means of satisfying a natural impulse. And if this be so, to a greater or less extent, where civilization, as we understand it, is unknown, are we not

justified in the conviction that the artistic instinct, subject to influences for good or for evil, is a common endowment of humanity. All else is dependent on culture, the work of successive epochs of continuous and increasing civilization, modified by the condition, habits, and surroundings of a people. As Mr. Gladstone observed in a speech delivered a few years ago—

"The sense of beauty is not, under natural and equal circumstances, the favoured inheritance of a few, but is meant to be, should be, and may be the universal inheritance of civilized mankind. . . . We are now coming, we have almost come, to the belief that music is a general inheritance, that the faculty of music is a common faculty of the people forming an intelligent community. Was that so fifty years ago? I remember the time when you were laughed at if you contended, as I was stoutly contending, that the human being, as such, was musical; you were considered a fool, a dreamer, an enthusiast. People used to say, 'I can't tell one note from another; I don't care a bit about music,' and I replied by saying, 'If the nurse who carried you when you were six months old had continued to carry you until you were forty, you would not be able to walk.'. . . If there be those who have no sense of music, they are analogous to those who are born deaf or blind, and consequently are entitled to sympathy as being excluded from one of the purest enjoyments Providence has ordained for human nature. I believe it is exactly the same with the sense of beauty. . . . The original capacity lies in the nature; that capacity is modified from generation to generation, and the cultivation of it in certain generations affects the capabilities with which the children of those persons are born into the world. Those whose parents have been conversant for a long period of time with the objects of beauty and the exercise of the faculty of taste have great advantages, a considerable start in the race. . . . But do not let us be discouraged because we have not any of these advantages. . . . In every one of us there is enough to work upon; it is upon the manliness and the fidelity of the effort made to improve that which we possess that the ultimate result will depend."

It would be scarcely profitable to dwell further upon the idea that the English people are by nature inartistic; their works may be appealed to as evidence that they are as receptive in this respect as in others in which they have become distinguished among the nations. If it were not so, indeed, there would be small hope of the effectual exercise of beneficial influences. Neither would it be

profitable to deal with the prognostics of pessimists who regard advance in art as a sure sign of national decadence; who seek support for their narrow conclusions in the fate of Greece and Rome, illogically associating it with the incomparable perfection attained by the artists of the ancient world, whose works, as our perceptive powers become more and more subtle and refined, become more and more the objects of our admiration and delight. These are themes the further discussion of which must be left to others, and their dismissal paves the way for that which is the immediate subject of consideration—the extent to which the artistic tendencies of this nation, in their application to industrial processes, have been and are being developed.

With respect to what has been, England may well claim for herself a notable and a characteristic place in the history of the past. It would, indeed, be surprising if it were otherwise; for a nation which has displayed so much inherent force in other directions, which has produced many of the greatest geniuses the world has seen, which in poetic feeling, in dramatic power, in maritime enterprise, in warlike prowess, in inventive genius, knows no superior, might well be expected to excel in any work demanding the exercise of great gifts and high intelligence. It would be easy to show that even in the days of Saxon Pagandom the inhabitants of these islands produced much that was artistic, especially in ornaments for the person. It was not, however, until Christianity dawned upon Britain that any material advance was made. The advent of a purer faith, with its high and ennobling influences, led to important results in the employment and education of art workmen, especially after the Normans took possession of the land. The Church was both generous and critical in its patronage, and thus rendered a double service in its encouragement of art. Shrines, crosses, vessels, vestments, became the subject of artistic attention, and received the best and costliest treatment that could be lavished upon them, under the immediate direction of those who for many generations,

even until the period of the Reformation, were the chief repositories of culture and scholarship. At Ely and at St. Alban's, in the eleventh and twelfth centuries, the goldsmith's art was practised within the Abbey precincts, and some images by the Abbot of Ely himself were stripped of their silver-gilt covering and the precious stones with which they were enriched, to appease the wrath of William the Conqueror, who wrung from the convent a thousand marks, obtained by the sacrifice of its gold and silver ornaments, after the determined stand made against the invader in the last Saxon "camp of refuge." Matthew Paris tells us that two candelabra made at St. Alban's Abbey were sent to St. Peter's at Rome, and the examples still left to us justify the conviction that at this early period English workers in the precious metals were as advanced in their beautiful art as any to be found on the continent of Europe.

As years passed on, the goldsmith's craft was in increasing demand, not only for princes and abbots, but for the great feudal lords, who, knowing nothing of the countless sources of expenditure opened up by the requirements of a more luxurious age, expended much of their superfluous wealth on gifts to the church, personal ornaments, and costly household plate, of which many persons of distinction had great store, no inconsiderable proportion of it being of pure gold. The treasure of Cardinal Wolsey, perhaps the most munificent patron of the goldsmith's art during the Tudor period, astounds us with its splendour. His biographer Cavendish tells us that—

"There was at banquets a cupboard as long as the chamber was in breadth, with six deskes in height, garnyshed with guilt plate, and the nethermost deske was garnyshed all with gold plate, having with lights one paire of candlesticks with silver and guilt, being curiously wrought, which cost three hundred marks. This cupboard was barred round about that no man might come nigh it, for there was none of all this plate touched—there was sufficient besides."

Such patronage was not, however, confined to nobles and ecclesiastics of high rank. People of lesser degree had

much gold and silver plate to bear in mind when declaring their testamentary intentions, as we learn from wills and inventories. The wealthy Trade Guilds also took advantage of every opportunity to enrich their tables and cupboards, and many of their beautiful cups, salvers, and other articles in the precious metals show what English taste and skill were in those days.

In another department of art-workmanship, not yet noticed, pre-eminent skill was displayed at a very early period of our history. In some critical remarks on vestments, a high authority (the Very Rev. Dr. Rock) states that several of the illuminations in that splendid MS., the Benedictional of Æthelwold, in the possession of the Duke of Devonshire—itself the work of an Anglo-Saxon artist, and stated by Mr. Richard Holmes, of the British Museum, to be the most richly adorned example of the illuminated work of the 10th century in existence—show how elaborately were the mass vestments embroidered by the Anglo-Saxons of that period.

"So rich and beautiful were they (says Dr. Rock) that the Norman William carried many of them off, and bestowed them on the churches of Normandy. Up to the 16th century the same principle was acted on, and from a visitation made, A.D. 1295, of St. Paul's, London, we learn how rich, as well as numerous, were the vestments belonging at the time to that Cathedral. The inventories of Canterbury, York, and Lincoln, taken at a later date, bear like testimony for each of their respective churches; while the wills of our bishops, dignified churchmen, nobility, and gentry of the olden times give evidence that hardly was there here a parish church or domestic oratory without its splendid vestments. No kingdom in Christendom was better furnished with them, and their tissues were of the most beautiful and costly that might anywhere be found. . . . To many at the present day it is a fact entirely unknown, that for ages this country was celebrated for the beauty of its embroideries; and vestments wrought in England awakened such admiration abroad that they were eagerly sought for there. Eadmer, who went along with the Archbishop of Canterbury to a Council at Bari, A.D. 1098, tells us that a cope given years before, by Ægelnoth, the Anglo-Saxon primate, to an Archbishop of Benevento, was unmatched in beauty by any other vestment he saw in Italy, or worn in that numerous assembly of bishops. Such praises bestowed upon the best of our home-wrought vestments, as real works of art, are fully borne out by the scanty remains

of those English embroideries which have happily reached us through so many perils from wanton destruction or ordinary decay. . . . Though the nuns were the principal, they were not by any means the only embroiderers of vestments for the Church. All along from the Anglo-Saxon period our royal princesses and our high-born dames loved to busy their needles upon such work. Besides women, men too were taught and practised embroidery, and this as well as other works of useful or decorative art was followed by the monks. Writing to Cromwell, Giffard, one of the Commissioners for the suppression of the smaller houses in the reign of Henry VIII., thus speaks of the monastery of Wolstrope, in Lincolnshire :—'Not one religious person there but that he can and doth use either imbrothering [embroidering], writing books very fair hand, making their own garments, carving, painting, or graving'; what was done in this was also done in other monasteries."

There can be no doubt, either, as to the manufacture of excellent tapestry in England in mediæval and later times, for we learn from M. de Champeaux that in 1344 Edward III. passed a law for its regulation, and in 1392 the Earl of Arundel disposed by will of the tapestry in his castle, which had been recently made in London. At a later date the monks of Canterbury manufactured hangings in tapestry for the walls of their choir, and these are now at Aix in Provence. Throughout the 16th century a manufactory existed at Barchester, Warwickshire, and both James I. and Charles I., patronised one established in 1619 at Mortlake, Surrey, by Sir Francis Crane, the last lay Chancellor of the Order of the Garter. Some remarkably beautiful work was produced at Mortlake, and the success of the manufactory (which disappeared at the beginning of the 18th century) attracted a great number of tapestry workers from Oudenarde, where the art had been practised from the middle of the 15th century.

"Charles I. (continues M. de Champeaux) commissioned them to reproduce the beautiful compositions of the Italian artists which decorated his fine gallery, and principally the magnificent cartoons of Raphael representing the Acts of Christ and his Apostles. These cartoons were found in the manufactory at Brussels, where they had been forgotten after the execution of the tapestries for the Vatican, and Charles, by the advice of Rubens, bought them. The greater number of these pieces of tapestry, which were bought by Mazarin at the sale of Charles I.'s property, and notably those representing the

Acts of Christ and his Apostles, after Raphael, have found a refuge, after many vicissitudes, in the 'Garde Meuble' at Paris. . . . The civil war which troubled England at the end of the reign of Charles I. put a stop to the artistic productions of this manufactory; but at the Restoration Charles II. granted to it the same protection as his father. He sent to it again the cartoons of Raphael, which Cromwell, to preserve them for the nation, had bought at the sale of the effects of Charles I."

There is also no doubt as to the existence of numerous artists in ivory carving in this country in mediæval times. The late Sir Digby Wyatt, in a lecture delivered before the Arundel Society, says—

"The English style may be assigned a positive position midway between the French and the second Italian manner. It does not exhibit the gaiety and tenderness of the former, nor has it quite the grandeur of the latter, but it is marked by a sober earnestness of expression in serious action which neither of these styles possesses."

Another authority (Mr. Wm. Maskell) states that—

"The English school had less of the monotony and mannerism which are the derogatory features of the continental examples of the same period; in fact, English Gothic ivories have both a purity and a variety of treatment on a par with the admirable characteristics of contemporary architecture in this country."

By far the greater portion of our early works of art, especially in the precious metals, have in the lapse of centuries vanished from existence. For the most part the crosses, chalices, lamps, candlesticks, monstrances, reliquaries, and other appliances of the Romish ritual were ruthlessly destroyed at the Reformation, when most of the Church plate was sent to the melting-pot. During the short reign of Edward VI., the Protector Somerset issued an order under which every man found in possession of a representation of Our Lord, the Virgin Mary, or any picture stories, was liable to a fine, and on a second repetition of the offence, to imprisonment; and the gay cavaliers of Elizabeth's time sometimes indulged in the destruction of pictures, statues, and windows, for mere amusement. Indeed, an action was brought against a gentleman of fortune named Sherfield on account of some mischief of this kind,

and the Attorney-General (who conducted the prosecution) said he believed there was such a predilection for the destruction of art that there were people who would have knocked off the cherubim from the ark! At the end of the 15th century the great revival known as the Renaissance led to further destruction of the old work, in order that it might give place to new; and other causes for its disappearance will readily suggest themselves to the reader, such as civil commotion or the pecuniary necessities of the hour, as when Pope Clement VII., besieged by the Spaniards in the Castle of St. Angelo, directed Benvenuto Cellini to unset all the precious stones in the Papal tiaras, sacred vessels, and vestments, and to melt down the gold, of which he thus obtained two hundred-weight, for the payment of the troops. Really, the marvel is, not that so few, but that so many specimens are still left to us. Both at South Kensington, and in private collections, examples of surpassing interest—amongst which may be mentioned the Gloucester candlestick, the Lynn cup, and the Syon cope—bear testimony to the excellence of English workmanship at this remote period. It may be said, to quote the words of Mr. J. Hungerford Pollen, in some remarks on the gold and silver work of the 13th, 14th, and 15th centuries, that—

"If the sculptors and modellers of the 13th century had not learned in the scientific manner of the 16th, they faithfully followed the living model as they saw it . . . . Of the grace and dignity of both armour and civil dress, the drapery of women, and the habits of ecclesiastics, we can have no truer representation than the many images on tombs still remaining to us . . . . Teaching that had been diligently carried on in monastic enclosures bore sound fruits. Hundreds of artist workmen could design and model correctly and with ease. In manuscript illuminations and ornaments, in hammered or chased metal work, in enamel and niello decorations, the lines are drawn with a firm and dexterous hand, perfectly trained for the work to be done. These artists were of unequal merit, as at all times, but none of their work shows ignorance or hesitation; ignorance, that is, of what may be called the stores of accomplishment of that day, or hesitation in carrying them into execution."

Before passing from this period, the work of our early

modellers and sculptors in stone and bronze demands some attention. Characteristic sculptures of the 10th and 11th centuries may still be seen at Chichester, Ely, Winchester, and elsewhere, and those which adorn the Cathedrals of Wells, Lincoln, and Lichfield, may also be cited as evidence of high capability. Though an Italian origin has been claimed for Master William Torell, goldsmith and citizen of London, mention may be made of his beautiful gilt bronze effigies of Queen Eleanor and Henry III. in Westminster Abbey. The tomb of Richard Beauchamp, Earl of Warwick, at Warwick, can be referred to without hesitation as the work of English hands, and many other examples of our early modelling may well be regarded with pride, if not with humility.

In connection with these memorials of the past, reference should be made to an art which was introduced into this country at the end of the 12th century, and in which English workmen displayed surpassing excellence at the very outset—namely, the employment of effigies in engraved metal as memorials of the dead. Notwithstanding the wholesale destruction of the Commonwealth period and the sad neglect of later years—which in York Minster alone have deprived us of all but one of 120 "brasses" known to have been there at the beginning of the 17th century—there are still about 2000 left in our cathedrals and parish churches, and the drawing and execution of the earliest examples, a few of which remain, excite the admiration and astonishment of the modern artist. Again, our early seals, ecclesiastical, civic, and personal, admirable as they are both in design and execution, afford additional evidence, if any were needed, of the fact that under the Plantagenet Kings Englishmen excelled in all workmanship demanding refined artistic feeling and delicate executive skill.

The development of artistic taste throughout this period is also especially manifest in our church architecture, many noble examples of which have survived the neglect of ages, and (what has sometimes been still more perilous) the work of restorers. Our great cathedrals are filled with

work which may also be found in all its excellence, though not on so important a scale, in our parish churches ; and the structures themselves, though sharing the general character of continental Gothic, display great originality of treatment and not mere slavish reproduction. The woodwork, too, is most remarkable for that particular kind of beauty in which one recognises the human influences of hand and eye, and which can never be produced by the purely mechanical precision of rule and compasses. Here again the influence of the cloister was distinctly felt both in constructive ingenuity and beauty of detail : as an example of the former the work of Alan de Walsingham at Ely may be referred to. Westminster Hall also demands particular mention as a building that has no parallel in Europe for the grandeur of its proportions and excellence of its construction. Even the more degenerate architecture of the Perpendicular period was nobler than that which marked a contemporaneous decadence in continental States ; and our singularly beautiful fan tracery, so peculiarly English, may be referred to as evidence of this.

In a paper on fresco painting, placed before the Select Committee appointed in 1841 in connection with the rebuilding of the Houses of Parliament, Mr. (afterwards Sir Charles) Eastlake bears the following testimony to our early artistic excellence:

"We should dwell on the fact that the arts in England under Henry III., in the 13th century, were as much advanced as in Italy itself ; that our architecture was even more characteristic and freer from classic influence ; that sculpture, to judge from Wells Cathedral, bid fair to rival the contemporary efforts in Tuscany, and that our painting of the same period might fairly compete with that of Siena and Florence. . . . The first conviction that should press upon us should be that our own country, and our own English feelings, are sufficient to produce and foster a characteristic style of art ; that although we might share much of the spirit of the Germanic nations, this spirit would be modified, perhaps refined, by our peculiar habits ; above all, we should entirely agree with the Germans in concluding that we are as little in want of foreign artists to represent our history and express our feelings, as of foreign soldiers to defend our liberties."

Is it not therefore abundantly clear that during the Middle Ages the all-important characteristics of the art-workman—artistic feeling and mechanical skill—were abundantly manifest in this country, so far as they were elicited by the requirements of the time? In those branches of art which received encouragement, material progress was made; without such encouragement no such progress has been apparent in any nation or at any period. As in the highest departments of art, so in the most unimportant application of its principles to the purposes of manufacture, it is the want that creates the work, which in its turn excites fresh impulses and demands, action and re-action combining to develop the powers of a nation and lead it upwards to artistic excellence. This advance was steady and continuous until the period of the Reformation, which, as we have seen, affected other matters besides the relations between England and Rome, between independent sovereignty and Papal authority. The Fine Arts, checked in their progress, were deprived of their great patron the Church, and were relegated for the most part to domestic work, though the art of the sculptor was still kept alive by the demand for monumental effigies. There was also a marked decadence in our church architecture, and a corresponding deterioration in all work capable of artistic treatment, for this had been greatly dependent on our architectural excellence, deriving from it many details of construction and enrichment. But other forces were also beginning to make themselves felt, and to these we owe what was to some extent a compensatory advance in another direction. The discoveries of Columbus and Vasco da Gama, following close upon one another at the end of the 15th century, were factors of the first importance in the subsequent growth of England's wealth and greatness. Her trade, no longer confined within narrow limits, became oceanic, and found new fields of enterprise in the far East and the far West, sharing with other maritime nations the profits which fell to merchant adventurers in the newly discovered markets of the world. Thus was laid the founda-

tion of that abundant wealth, which, flowing into various channels, found some employment in the erection of the princely mansions of the "Tudor" and "Elizabethan" periods, examples of which may still be seen at Hatfield, Hengrave, Haddon, &c.* The houses of the Jacobean and Queen Anne periods, though less superb in design and treatment, are nevertheless admirable and characteristic, as peculiar to England and as distinct from anything to be found abroad, as an English country-house of the 19th century, with its charming home-like luxuriousness and comfort, is from a modern French château.

The English sovereigns of the House of Tudor were patrons of art, but their patronage was personal rather than æsthetic, relating chiefly to the adornments of their dress, their table appointments, armour, &c. Henry VII. indeed made the beginning of a collection of the paintings, books, plate, and furniture of his houses, some of which may still be found in the royal palaces; and we also know that Holbein, after spending three years in England under the wing of Sir Thomas More, was taken into the employment of Henry VIII., but it is doubtful if his great gifts would have found much favour in the royal eyes had he not been able to limn the "royal image," as the "counterfeit presentment" of the king was termed in the patent of office granted by James I. to Nicholas Hilliard, the earliest of English miniature painters. Charles I. is the first English sovereign who appears to have devoted much attention to art for its own sake. It was at his invitation that Rubens passed a twelvemonth in England, and that Vandyke spent in this country the last twelve years of his life; and the work of these two great painters awakened among us the first symptoms of renewed vitality in the Fine Arts. Charles I.

* A volume in Sir John Soane's Museum contains an interesting series of plans and views of houses designed by John Thorpe, a notable architect of this period. They include Buckhurst Hall, Kent; Woolaton Hall, Notts; Burleigh, Northampton; Holland House, Kensington; Audley End, Essex; Longford Castle, Wiltshire; and Holdenby House, Northamptonshire.

also formed a superb collection of paintings by the great masters, the dispersion of which under the Commonwealth is a source of lasting regret.* There had also been an earlier collector in the field, for the Earl of Arundel had begun the formation of his noble collection of sculpture when Charles was a boy. "To his liberal charges and magnificence," says a seventeenth century writer, "this angle of the world oweth the first sight of Greek and Roman statues, with whose admired presence he began to honour the gardens and gallery of Arundel House." It may be added that in Charles's time, and that of his immediate predecessors on the throne, artistic workers in metal attained a very high degree of perfection in England, and Thomas Simon and other medallists of this period also produced some very fine work.

The fervour of the zealots of the Commonwealth rolled like a wave of destruction over the artistic and the beautiful, and the work of Dowsing and his fellows inflicted incalculable damage on the sculpture, carving, and painted glass of our churches and cathedrals throughout the land, the memorial brasses being also torn from their matrices, and disposed of as old metal. The Restoration brought renewed patronage to art, and especially to portraiture; the foreign painters, Lely and Kneller, found abundant employment at Court, and the latter retained the royal

* This collection, which had for its nucleus the entire gallery of the Duke of Mantua, considered the most important in Europe, and purchased by the king at a cost of £20,000—a very large sum in those days—included in Whitehall Palace alone no fewer than 460 pictures, and amongst them were two by Michael Angelo, nine by Raphael, seven by Rubens, three by Rembrandt, three by Albert Dürer, two by Annibale Caracci, two by Leonardo da Vinci, sixteen by Vandyck, four by Paul Veronese, four by Guido, eleven by Holbein, eleven by Coreggio, and twenty-eight by Titian! An abstract of the sale of the pictures at Whitehall, St. James's, Hampton Court, Somerset House, Greenwich, Oatlands, &c., shows that there were about 900 paintings and 270 pieces of sculpture in this superb collection, and it is stated in Walpole's *Anecdotes of Painting* that they were sold, with the remains of the king's jewels and plate, and the furniture of nineteen palaces, for £118,080 10*s.* 2*d.*

favour under no fewer than five sovereigns, being eventually created a baronet by George I. The great fire of London provided a clear field for the architecture of Wren, of whose work the country is justly proud, and various handicrafts were stimulated by the necessities arising from this catastrophe. But during the latter half of the 17th century and the greater portion of the 18th the state of the arts in England was, generally speaking, a state of neglect and degradation. There were, of course, many isolated examples of excellent art-workmanship; as, for instance, the beautiful work executed by Huntington Shaw, the Nottingham blacksmith, for Hampton Court Palace;* and some streaks of the coming dawn were observable in the establishment of the Society of Arts, the British Museum, and the Royal Academy; in the foundation of a school of portraiture infinitely in advance of any contemporary school; and in some remarkable instances of advance in art-manufacture. The names of Thornhill and of his greater son-in-law Hogarth, of Reynolds, Gainsborough, Wilson, Turner, and others, in painting, and of Bacon, Banks, and Flaxman, in sculpture, are names which suffi-

* Of the twelve gates or screens which formerly stood at intervals of fifty yards in the fence dividing the river terrace at Hampton Court from the Home Park, six are now preserved in the South Kensington Museum, two are in the Guard Chamber at Hampton Court Palace, others are at Edinburgh, Dublin, and Nottingham, and the twelfth is still standing, greatly injured by the weather, in its original position. "A new Booke of Drawings invented and designed by John Tijou," published in London in 1693, contains one of these wrought-iron screens, and as the public records show that large payments were made to Tijou for iron gates, stair-rails, and other work done at Hampton Court, it has been supposed that he designed the work which Shaw executed. On the other hand we have, however, the important evidence afforded by the inscription on Shaw's tablet at Hampton, which states that he died in 1710 at the age of 51, that "he was an artist in his way," and that "he designed and executed the ornamental ironwork at Hampton Court Palace." Even if the designs were really made by Tijou, whose plates were subsequently appropriated by a fellow-countryman named Fordrin in a work entitled "Livre de Serrurerie de Composition Angloise," it would not deprive Shaw of the merit to which the extreme beauty of the screens is mainly attributable—the *artistic* excellence of the workmanship.

ciently indicate the improved condition of English art at this period. The importance of the industry established by Josiah Wedgwood, under the guiding influence of Flaxman's genius, need not be dwelt on here. Much of the work produced, not only by Wedgwood, but also at Chelsea, Derby, Worcester, and other English porcelain works, is equal in merit to the best foreign productions. There was also a notable revival of wood-carving at the beginning of the 18th century, under the influence and example of that incomparable master in the art, Grinling Gibbons; and at a somewhat later period unprecedented excellence in English furniture—which, even in Elizabeth's time, was distinctly characteristic, though based on the work of the Flemish artists—was displayed in the productions of Chippendale and others, never sought for with more avidity than at the present time. The brothers Adam also deserve mention, not only for their architecture, but as successful designers of furniture, carriages, plate, &c. It was, however, not isolated and occasional effort, but prolonged and continuous cultivation of the sense of beauty which resulted in the perfection of Greek art, still the noblest example to the world, as it has been for the last two thousand years or more. And it is to prolonged and continuous cultivation that we must look in these modern days for progressive and enduring excellence both in the fine arts and in the art of applied design, invigorated in our efforts by the examples of the past, and encouraged under disappointment and failure by the reflection of Sir Joshua Reynolds, that "though no method of study will lead to excellence, yet it may preserve industry from being misapplied."

CHAPTER II.

ORIGIN AND DEVELOPMENT OF SCHOOLS OF ART.

IT is a trite saying that "circumstances alter cases," and, if due allowance be made for the force of its truth, sufficient has, it is hoped, been said to establish the point that throughout their earlier history the English people have shown themselves, not only susceptible of artistic feeling, but also successful in its practical application. Though later starters in the race than some, it by no means follows that we may not attain as high a degree of excellence as any, with proper guidance and under favouring circumstances. In our own time, it may be observed, there is an element of encouragement highly esteemed by most natures, but which was entirely absent from the considerations of the workers of bygone ages. They had, indeed, the approval of the few for whom they laboured or among whom they lived, and they had also the rarer approbation which a true artist so seldom experiences—the supreme satisfaction arising from the reflection that he has not only done his best, but has also been enabled to realise by the work of his hands the conception of his thought. They knew, however, nothing of the renown and *éclat* which in these days of newspapers, telegraphic agencies, and popular literature, await those who attain to any kind of eminence. The fierce glare of publicity is thrown on matters comparatively unimportant in the effort to supply the British reader with his morning pabulum, the daily paper; and achievements which, fifty years ago, would have been honoured with only two or three lines of notice in the leading journal, are now the subject of lengthened remark, and perhaps serve as a peg on which to hang a discursive

disquisition in the shape of a leading article. In the old times good work could not, in the nature of things, become known beyond the radius of a very limited circle, and many an art-workman of the highest merit has gone to his grave without any special recognition of his capacity, pecuniary or other, perhaps without being impressed with the belief that he deserved it. Allusion has already been made to the admirable work of Huntington Shaw, who lived and died a blacksmith, scarcely cognizant, perhaps, of the fact that he had a most delicate and subtle perception of the beautiful; and probably the warmest eulogium passed upon him until our own more appreciative times, is that recorded on his memorial tablet in Hampton Church, where he is described, certainly with no excess of enthusiasm, as "an artist in his way."

And if we look at the amounts asked for artistic work of the highest excellence, even in more modern times, we are impressed by the modesty of the demand. We learn from Miss Meteyard's 'Life of Wedgwood' that in the first bill sent in to him by Flaxman (in March 1775), the sum of three guineas was charged for a pair of vases, one with a Satyr and the other with a Triton handle, which are figured in the work alluded to, so that any one may judge of their merit; 10*s.* 6*d.* each for basso-relievos of Melpomene, Thalia, Terpsichore, Euterpe, Sappho, Apollo, Hercules and the Lion, Hercules and the Boar, and Hercules and Cerberus; 7*s.* each for relievos of Bacchus and Ariadne; and proportionately small sums for other works by this superb modeller.

The history of art instruction in this country affords in one respect a marked contrast to that of continental nations, for its growth with us has sprung in the first instance from individual impulse and effort, and not from initiatory proceedings on the part of the Sovereign or the State. We have seen that art has always received a certain amount of patronage from the court and the palace, but the patronage has been of a kind which was willing to accept what art produced rather than to encourage its

production by supplying the people with artistic teaching, and so developing their artistic instincts. On the Continent, on the contrary, the State has often been the first to project artistic works, and to subsidise them by the payment of public money. It may be that this was not due to far-seeing wisdom or patriotic motive, but the fact nevertheless remains that it was done abroad, and was not done at home. Flemish workmen were brought to Fontainebleau by Francis I., who there established, in 1539, a manufactory of tapestry which was kept up by his successors ; a hundred years later Colbert, Minister of Louis XIV., took the manufactory of the brothers Gobelin under his protecting care, and secured for France a large share of the lace manufacture by establishing the works of Alençon ; and in the following reign the famous porcelain works at Sèvres were established. Royal in their origin, the works in the Rue Mouffetard and at Sèvres are still Government establishments, not dependent on profit for their existence, but encouraged in the production, regardless of cost, of work of the highest merit ; and the instruction there imparted to generations of workmen, trained under circumstances so favourable to the attainment of excellence, has necessarily had great influence on the art-industries of France. The well known Lyons School, which has perhaps done more in this respect than any other institution, was founded in the middle of the last century for the express purpose of instructing draughtsmen in preparing patterns for the silk manufacture of that city, and was placed on its present footing by a decree of Bonaparte, whose well-known series of medals, struck to commemorate the glories of his dazzling career, must also have contributed to the diffusion of artistic taste. The great palaces erected in Paris and its neighbourhood by successive sovereigns, and on which the greatest artists in France were employed, have served as so many schools of art, and their contents have been freely thrown open to the public. In our own country, on the contrary, all movement in the direction of art culture has arisen from individual effort, and, in quite recent times,

from public requirements. Thus, although we may be later and slower in developing those powers which achieve for a nation a high artistic reputation, we have, it may be hoped, a more solid foundation for our operations, even as the fruit ripened naturally under the influence of the sun is to be preferred above the artificial and premature maturity of the hothouse. Mr. Gladstone, in the address already quoted, regards it as "a very great misfortune" when the central State agency becomes the originating and governing arm in matters of this sort.

"It ought to be," he adds, "an auxiliary agency altogether. I believe that is the conception the Department has of its own functions, and I trust and hope that conception may be entertained with great utility to the country. . . . It is really in the individual that the secret of the whole matter lies. . . . No auxiliaries, however pompous and ostentatious, can supplant that principle of individual energy, and, in so far as they tend to supplant it, they are not doing good, but they are effecting absolute mischief."

It appears that in the middle of the last century independent steps were set on foot in England, Scotland, and Ireland for the establishment of institutions having for their object the encouragement of manufactures, and from each of the organizations so established sprang results of importance to this narrative. First in order of date was the formation in Scotland, in 1727, of the Board of Trustees for the Encouragement of Manufactures;* next, the formation, in 1731, of the Dublin Society; and third, the institution in London, in 1754, of the Society of Arts.

* The origin of this Board of Trustees is a curious one, being derived from an Article of the Treaty of Union between England and Scotland, under which, a large sum being due from England to Scotland as an equivalent for certain alterations in the respective revenues of the two countries, a portion of that sum was converted into an annuity of £2000, redeemable by Parliament on payment of £40,000; and this annuity, or the price of its redemption, was to be employed in all time in promoting the fisheries and manufactures of Scotland. This annuity was determined on in 1720, but as the Board of Trustees was not actually constituted till 1727, there were then arrears amounting to £14,000, and this sum formed the foundation of their funded property. The annual grant of £2000 has since been continued.

In 1835 (according to some evidence given in that year before the Select Committee on Arts and Manufactures, by Mr. Skene, Secretary to the Scottish Board of Trustees) their total income, including that derived from funded property, amounted to £4,315. The Board had erected in Edinburgh a large building known as the Royal Institution, for the accommodation of different learned bodies, to some of whom grants were annually made, including £500 to the Royal Institution of Arts and £430 to a drawing academy established about the year 1766, in order to counteract the advantage which foreigners derived from the teaching of design. A Frenchman named De la Croix was the first master of the school, and the pupils (to the number of forty) were admitted gratuitously on presenting satisfactory evidence of their artistic skill and capacity, and of their good character. This school soon gained great repute under a series of eminent teachers, and its training was very successful, especially in the higher branches of art. Sir David Wilkie, Sir William Allan, and Sir J. Watson Gordon were fellow-students here; indeed, Mr. Skene stated that there was scarcely an eminent name in the history of Scottish art that was unconnected with the school. It will be interesting to mention, that some time previous to 1835 this Board of Trustees established a branch school at Dunfermline, for the express purpose of teaching pattern-drawing for table-cloths, diapers, &c., and agreed to give £50 a year to a master, if the local manufacturers would provide the like amount. For some years this arrangement was carried out, and the school did good service, the Board offering further encouragement, in the form of premiums for the best specimens of linen manufacture. In 1834, however, the number of subscribers became reduced to two or three, and as these were disinclined to provide the stipulated local contribution, the Board was asked to find the whole of the £100. This, however, was incompatible with the ideas of the Trustees, and the Dunfermline school fell to the ground—an early example of the shortsightedness of

manufacturers in neglecting to maintain, at an inconsiderable cost to themselves, an institution in the highest degree important to their interests. The drawing school at Edinburgh was affiliated to the Science and Art Department in 1858, and is still carried on at the Royal Institution.

The Dublin Society, founded as early as 1731, and incorporated by Royal Charter in 1749, claims to be the first body in the United Kingdom to offer premiums for the encouragement of drawing and the promotion of art. Its earlier premiums were competed for, not only by students of art, but also by artists and amateurs and the public at large, and many were gained by the pupils of a private drawing school, kept by a Mr. West in George Lane, Dublin. It was urged that the establishment of a public and free drawing school would tend to advance the arts, and the society built a large room in 1741, suitable for the purpose, on their premises in Shaw's Court, Dame Street, Dublin. The earlier premiums awarded by this society were distributed to the pupils, &c., at the Parliament House in Dublin, now the Bank of Ireland. The schools, from the date of their establishment, were called the "Drawing Schools of the Dublin Society," and received an annual grant from the Irish Parliament of £500, which was continued during 105 years. In 1849 an additional grant of £500 was made by the Board of Trade, upon the amalgamation of the old schools (whose chief aim was high art education) with the newly instituted schools of design, which had for their particular object the direct application of art to manufactures. It is worthy of remark that this school, established by the Dublin Society in 1741, has since been in operation without intermission, and has been most successful in training architects, sculptors, designers, and pictorial artists.

The Society of Arts—or, to give it its full and more suggestive style, the Society for the Encouragement of Arts, Manufactures, and Commerce—was instituted in London in 1754, and incorporated by Royal Charter in 1847. The credit of having proposed the formation of this important

society, which has been of inestimable practical value in the precise directions indicated by its title, is due to a landscape painter named William Shipley (brother of the then Bishop of St. Asaph), who in 1753 suggested its establishment, and a School of Design was one of its first offshoots.* Mr. Shipley himself superintended it, and Richard Cosway, the celebrated miniature painter, received the first premium of £5, at the age of fourteen.†

* This School of Design was the result of a meeting of noblemen and gentlemen, clergymen, and merchants, held at Rawthmell's coffee-house, Henrietta-street, Covent Garden, on the 22nd of March, 1754, when it was proposed, amongst other matters, to give rewards for the best pieces of drawing, "and it being the opinion of all present that the art of drawing is absolutely necessary in many employments, trades, and manufactures, and that the encouragement thereof may prove of great utility to the public, it was resolved to bestow premiums on a certain number of boys and girls under the age of sixteen, who shall produce the best pieces of drawing, and show themselves most capable when properly examined." We learn from a note appended by Burnet to the earliest of Sir Joshua Reynolds' Discourses that there were present at this meeting Viscount Folkestone, Lord Romney, Dr. Hales, Mr. Goodchild, Mr. Lawrence, Mr. Messiter, Mr. Crisp, Mr. Baker, Mr. Brander, and Mr. Shipley, who acted as Secretary. At their next meeting, in the following week, an advertisement was drawn up offering their first premiums, viz., "for the best drawings by boys and girls under the age of fourteen years, and proof of their abilities on the 15th day of January, 1755, £15, to be determined that day fortnight; likewise for the best drawings by boys and girls between the age of fourteen and seventeen, with like proof of their abilities on the same day, £15, to be determined that day fortnight." Nor did the Society confine their premiums to youthful candidates only, but extended their patronage to historical paintings, landscape, sculpture, and architecture, without limitation as to the age of the candidates, and in the space of twenty years expended the sum of £7,926 5*s*., besides ten medals of gold and six of silver, seventeen gold palettes and eight-four of silver.

† Cosway, being a native of Tiverton, had been placed by his uncle with Hudson—under whom Sir Joshua Reynolds (also a Devonshire man) served two years' apprenticeship—and during the next ten years he won four more premiums from the same society. In 1770 he became an Associate of the Royal Academy, and in the following year he attained to the full honours of Academician. As a miniature painter he outstripped all rivals, and in consequence of his tendency to work up to a flattering ideal he is said to have "painted more lovers' portraits than any ten artists of his time." He was appointed Principal Painter to

At an early period of its existence the Society of Arts also offered prizes for excellence in various branches of manufacture, and publicly exhibited the articles so collected, the displays thus brought together being the forerunners of those greater and more important exhibitions which in recent times have owed so much to the activity of the Society, and have had such important effects in revealing both our merits and our defects in comparison with the productions of other civilized nations. The Society's earliest attempts to foster artistic knowledge and to impart it to the rising generation were supported by the action of the Duke of Richmond, who had brought from Italy a rich collection of marbles and casts from the antique. His Grace, liberal and enlightened, threw open his collection to the public as a drawing school, under the direction of Wilton and Cipriani, two of the original members of the Royal Academy, who officiated without a salary, and it is justly observed by Burnet that "as this was the first public school which was opened where a knowledge of the beauties of the antique was to be learned, it cannot be too highly appreciated, nor can the disinterestedness of the profession in fostering the foundation of a School of Design in England."

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the Prince of Wales, and gave himself great airs as a man of fashion, living at a handsome house in Stratford Place, Oxford Street, where Mrs. Cosway's musical parties were among the chief attractions of the *beau monde*. He gathered around him a superb collection of pictures by the old masters, enumerated and described in a catalogue of 50 pages, published in 1791, at which time he was living in Pall Mall. These included 118 pictures in the "great saloon," 31 in the "eating room," &c.; altogether no fewer than 478 examples of the Florentine, Roman, Venetian, Lombard, Flemish, and Dutch schools, were at that time to be seen upon his walls. The Society of Arts possesses two examples of his work, one of them a portrait of William Shipley, its originator; and others are to be seen in the South Kensington Museum and in many private collections. In his declining years Cosway became very eccentric, and his vanity was such that he desired to have his remains carried to Antwerp and laid by the bones of Rubens. The parish of Marylebone is, however, the last resting-place of a man who deserves particular mention here as the first English student who received a premium for drawing in a School of Design.

These early movements, which in England, Scotland, and Ireland resulted in the formation of schools whose work had a direct influence on practical art, having been briefly touched upon, mention must next be made of the establishment of two institutions, the importance of whose functions it would be difficult to over-estimate—the British Museum and the Royal Academy. Here again it was individual, rather than legislative, action which was the motive force. Until the middle of the last century the project of establishing a national museum was not entertained in England. The idea found expression in the will of a public benefactor, Sir Hans Sloane, who directed that his collection of manuscripts, books, works of art, and objects of natural history, which had cost him £50,000, should be offered to the nation for £20,000. The offer was accepted, the collection was vested in trustees for the use of the public, and the Act of 1753, which directed their purchase, directed also the purchase of the Harleian MSS., and enacted that the Cottonian MSS., given to the nation fifty years before, should form part of the collection. To defray the cost of these purchases, and provide a place for their reception, the Act directed that £100,000 should be raised by lottery, and the net produce vested in the trustees charged with the management of the new institution, which was called the British Museum. The net produce amounted to £95,194, of which £20,000 went to the executors of Sir Hans Sloane, £10,000 to the Earl and Countess of Oxford for the Harleian MSS., £10,250 to Lord Halifax for Montagu House, and £12,873 for its adaptation to its new purposes, whilst £30,000 was set apart for salaries, taxes, &c., and £4,660 for furniture. The Museum was opened at the beginning of 1759, and in 1772 it received the Hamilton collection of Greek and Roman antiquities; in 1801 the Egyptian monuments acquired by the capitulation of Alexandria; in 1805 the Townley marbles; and in 1816 the Elgin collection, the most important artistic addition secured by the Museum since its establishment.

The Royal Academy, too, owed its origin to the

independent proceedings of a few English artists, who in 1711 formed an Academy, with Sir Godfrey Kneller at its head. A second attempt of the same kind was made about a dozen years later by Sir James Thornhill, who started an Academy in his own house in the Piazza, Covent Garden, after having ineffectually endeavoured to induce the Government to take the matter up. An exhibition of the works of living English artists at the Foundling Hospital brought them so much renown that a more important exhibition (to which Sir Joshua Reynolds sent four pictures) was opened in April 1760, in the great room of the Society of Arts. Next year, desiring to have the exhibition entirely under their own control, the artists removed it to an auction-room in Spring Gardens, Hogarth being one of the contributors, and in 1765 they obtained a charter from George III. and exhibited as the Chartered Body of Artists of Great Britain. This organization did not, however, work satisfactorily; the more eminent artists seceded, obtained a fresh charter of incorporation, and soon obtained a firm and permanent footing as the Royal Academy.

In the early part of the 19th century fresh impetus was given to the progress of the Arts, and, indeed, to the progress of the country generally, first by the peace and consequent prosperity which followed the crowning victory of Waterloo, after a long period of exhausting warfare; and next by the important changes brought about by the application of steam power to locomotion by land and sea. With increased riches came increased inclination for articles of luxury, and opportunity for the cultivation and gratification of refined tastes. The Arts experienced renewed encouragement, and a more favourable opening than any that had previously existed was afforded for the development of that particular kind of art-culture which is applied to the practical purposes of manufacture. The formation of the National Gallery had necessarily a material effect in strengthening the position of the Fine Arts in this country, setting before the public as a free and open exhibition what they had never yet seen, except at Dulwich, Windsor,

Hampton Court, and in private houses—a collection of the best examples of the great masters. This again, was another instance, humanly speaking, of accident rather than of design.* In 1823 Sir George Beaumont desired to present his collection of pictures to the British Museum, and as the accommodation there was insufficient Mr. Agar Ellis (afterwards Lord Dover) moved in Parliament for a grant for the purchase of Mr. Angerstein's and other collections for the formation of a National Gallery. In the following year Lord Liverpool announced the purchase of the Angerstein pictures for the sum of £57,000, and the Trustees of the British Museum permitting the removal of Sir George Beaumont's collection from their own custody, these were, in 1824, exhibited with the others at Mr. Angerstein's house in Pall Mall, the Gallery thus formed being subsequently (in 1838) removed to Trafalgar Square.

From 1815 onwards some advance was observable in the public taste, owing chiefly to the greatly improved condition of the middle and lower classes, and increased facilities for intercourse with the Continent and inter-communication at home; but this advance was by no means rapid. In our manufactures, especially, there was an absence of originality and artistic taste, leading to their disparagement when placed in comparison with those of France and other European nations, and to the consequent pecuniary loss of our manufacturers. The little advance observable was almost entirely derived from abroad, and while Schools of Design were in full operation in France, Switzerland, Germany, &c., we had really no organization on which to base hopes of future improvement. Englishmen are not rapid in arriving at conclusions unfavourable to themselves, but at length the national shortcomings in all matters affecting art-manufacture made themselves felt to such an extent that it became necessary to seek a

* As early as 1792 a Mr. Cumberland, of Bristol, wrote a pamphlet recommending the formation of a National Gallery of sculpture, casts, &c., in aid of which Mr. Wedgwood offered the handsome sum of £1000, but nothing came of it.

remedy for a state of things so derogatory to the genius of the people, and so fatally opposed to their continued prosperity.

One important reason for our decadence is very forcibly put by Mr. Redgrave, R.A., who, dealing with the past relations between fine art and the arts applied to industry, observes :—

"In the Middle Ages, and at the period of the Renaissance, these relations were exceedingly intimate; the distinction between artist and designer had hardly arisen. The great German, Flemish, and Italian artists were not only the painters of altar-pieces, neither were they employed alone in decorating the walls of churches with the history of saint and martyr, but they designed the furniture of palace and church, the rich services for the banquet, the reliquaries, monstrances, chalices, the splendid candlesticks for the altar-table, even the hangings of the rooms and the robes of the priests. The architects were often at the same time both painters and sculptors; and they did not disdain to design, and often partially to execute, the interior decorations of the buildings they erected. Some of the most celebrated sculptors were equally celebrated as workers in metal, as delicate modellers, or as skilful chasers; and their handiworks in bronze, in gold, and silver, are still treasured for us in museums and collections. But gradually the range of the artist became more limited; those who practised as painters or as sculptors ceased to follow the cognate arts; the artist ceased to be the art-workman. The manufacturer arose, and then, in most countries, the relations of art to industry were relegated to a separate, and, as it soon came to be considered, an inferior class of artists. Yet it must be noted that all great improvements in taste may still be traced to the follower of fine art stooping once more to ally himself with the manufacturer, rather than to those who had started as designers for manufactures advancing to greater taste and skill in their branch of the profession."

Mr. Redgrave further remarks that this change of relation between artist and manufacturer began to arise in France, as in other countries, but the disseverance was there checked by the foundation of the royal manufactories of Sèvres and the Gobelins; added to which there is another reason for the alliance of French artists of high merit with industrial art :—

"In England, the great seats of those manufactures to which art is applied are far from the metropolis, in which our greatest artists

reside, and to which they press from all provincial towns. . . . Whatever advantages the manufacturer may offer to unite them to his interests, all press to the great art-centre. Paris is not only the seat of art, but largely also the seat of art-manufactures. . . . In England the intercourse between the studio and the manufactory is divided both by time and distance. In France the artist can see his own creations grow under the hand of the workman, can easily be consulted as to every change and difficulty, and find the highest class of instructed workmen close at hand, to aid in the realisation of his designs."

THE FIRST SELECT COMMITTEE OF THE HOUSE OF COMMONS.

Mr. Redgrave's observations, though penned at a later period, applied with great force to the state of things in 1835, when the first Government inquiry into the condition of our manufactures was set on foot. In July of that year, on the motion of Mr. William Ewart, M.P. for Liverpool, a Select Committee of the House of Commons was appointed "to inquire into the best means of extending a knowledge of the arts, and of the principles of design, among the people (especially the manufacturing population) of the country; also to inquire into the constitution, management, and effects of institutions connected with the arts." The inquiry was continued in the session of 1836, and the Committee divided the subject of investigation into three parts:—1, the state of art in this country and in other countries, as manifested in their different manufactures; 2, the best means of extending among the people, especially the manufacturing classes, a knowledge of and a taste for art; 3, the state of the higher branches of art, and the best mode of advancing them.

The Committee, of whom Mr. Ewart was chairman, examined a large number of witnesses, including Members of Parliament, manufacturers, artists, and artizans, and the general upshot of their evidence was, that there was a most lamentable deficiency of taste and artistic knowledge in the designs used in our manufactures, and that in this respect we were very greatly dependent on foreign skill, owing to the dearth of English designers. Dr. Bowring, a

member of the Committee, who had visited the Continent as one of the Commercial Commissioners of the British Government, and had made a report on foreign trade, said that if the manufacturing exports of France were examined, it would be found that in those departments of industry in which taste could be introduced into manufacture, the superiority of France was undoubted. Of her silk manufactures, for example, five-sixths of her whole production were exported, whilst of the silk manufactures of England, probably not more than one-eighth or one-tenth was sent to foreign countries. The reason for this was to be found in the superior excellence of French designs.

Many people had cherished the idea that there was in this country a blind, unreasoning prejudice in favour of French novelties, shutting their eyes to the fact disclosed by inquiry in any independent market, that the articles themselves had an essential superiority over our home productions. This patriotic self-complacency was, however, entirely dissipated by evidence which showed beyond a doubt that our shortcomings were mainly attributable to the absence of any methodical plan of training designers, and to the want of instruction experienced by our art-workmen. This deficiency was particularly manifest in silks, ribbons, shawls, and other articles of manufacture, and trade was very much depressed in consequence. Complaints were also made by various witnesses of the want of artistic designs in the interior decoration of our houses, in furniture, and indeed in almost every branch of industry involving the exercise of taste. Even when suitable designs could be obtained, such, for example, as those required for house decoration, there was a lack of workmen to execute them. And this deficiency was the more deplorable, because it appeared that there existed amongst our artizans an earnest desire for artistic information. Evidence of this was forthcoming from London, Birmingham, Worcester, Sheffield, and other places, and the Coventry workmen had even petitioned the House of

Commons for the establishment of a school of design in connection with the ribbon trade. It was shown that whereas there were no means of obtaining adequate instruction in England, there were in France about eighty schools of design, under the superintendence and partial support of the Government, and, generally speaking, they were open and free, and so popular that it was impossible (especially at Lyons) to provide for all who desired to enter them. In Bavaria, where linear drawing was taught in every village school, there were thirty-three schools of design in which art students spent three years after leaving the village schools, ultimately finishing their education in one of three polytechnic schools; and similar instruction was imparted in Prussia, Switzerland, and other European countries. It was stated that in England superior designs were beyond the means of any but wealthy men, and that whereas in France a leading manufacturer would employ three or four artists, in England one artist would supply eight or ten manufacturers. Indeed, it was very difficult in England to find good designers; generally speaking they had but little acquaintance with the principles of art. There was no designer at Coventry, for instance, and the manufacturers obtained their designs from professional designers, who travelled about the country, supplying, not only Coventry, but Manchester and other places. Books on art were also published by foreign governments for the instruction of workmen, but here they had to be content with a few periodicals, such as the *Mechanics' Magazine* and the *Penny Magazine*, set on foot by private enterprise, and the avidity with which these were read showed how acceptable was the information they afforded. Even where artists were employed as modellers or designers, they did not receive sufficient encouragement, and frequently wandered off to other pursuits.

The want of legal security in their patterns tended to discourage manufacturers from great expenditure in original designs, and although it was stated in a petition presented to Queen Adelaide, about the year 1831, praying

Her Majesty to patronise the lace trade, that there were 150,000 persons engaged in that industry, a witness called before the Committee said he only knew of two artists employed in designing for them. It was shown that the Mechanics' Institutions, which had sprung up since 1823, had in some cases devoted a portion of their funds to the formation of evening classes for teaching drawing and modelling, but the difficulty of finding persons competent to teach what was required was a hindrance to their usefulness. M. Bogaerts, Professor of History at Antwerp, assured the Committee of the improvement in the manufactures of Belgium, and in the national taste, since the reorganization, about fifteen years previously, of the system of instruction under which the teaching of design had become a part of the national education; and it was also shown that the application of art to a material not only encourages but sometimes creates a manufacture, a fact of which there has been abundant evidence, as for example, in the Wedgwood ware of the last century, and the Doulton art-pottery of more recent times, which latter, it may be added, owes its origin and importance to the influence of a neighbouring School of Art. In short, there was a general concurrence of evidence as to the desirability, from a national point of view, of establishing schools of art by the aid of Government assistance, though some were so enthusiastic as to doubt if a permanent annual allowance would be necessary. Mr. Cockerell, the architect, Mr. John Martin, the artist, and others, insisted on the fact—as to which there is some scepticism even now—that there was clearly no want of talent in the country, but sufficient to supply all its artistic needs; that there was indeed a great propensity to art; but that artists had not been directed in a course that would make their ability applicable to manufactures, owing to the want of encouragement and of scientific means to that end.

In August 1836 the Committee agreed to a report in which they felt constrained at the outset to make the

humiliating admission, based on the testimony they had received, that "from the highest branches of practical design down to the lowest connection between design and manufactures, the arts have received little encouragement in this country. The want of instruction in design among our industrious population, the absence of public and freely open galleries containing approved specimens of art, the fact that only recently a National Gallery had even been commenced among us, have all combined strongly to impress this conviction on the minds of members of the Committee. In many despotic countries far more development has been given to genius, and greater encouragement to industry, by a more liberal diffusion of the enlightening influence of the arts." The Committee proceeded to point out what, even in our own day, is too little considered by those who are most interested in the excellence of our manufactures, that is to say, the producers:

"To us, a peculiarly manufacturing nation, the connection between art and manufactures is most important, and for this merely economical reason (were there no higher motive), it equally imports us to encourage art in its loftier attributes; since it is admitted that the cultivation of the more exalted branches of design tends to advance the humblest pursuits of industry, while the connection of art with manufacture has often developed the genius of the greatest masters in design."

After alluding to the want of instruction experienced by our workmen, their desire for information, the greater extension of art throughout the mass of society abroad, the influence exerted by schools of design on the manufactures of foreign countries, and the awakened attention to the importance of this subject in many of our great towns, the Committee noticed the important fact that the British Government had that year, for the first time, proposed a vote in the estimates for the establishment of a Normal School of Design, and expressed an opinion that in the formation of such an institution "the direct practical application of the arts to manufactures ought to be deemed an essential element."

"In this respect," continued the report, "*local* schools, where the arts reside as it were with the manufacture to which they are devoted, appear to possess many practical advantages. . . . But if a more *central* system be adopted, the inventive power of the artist ought equally to be brought to bear on the special manufacture which he is destined hereafter to pursue. . . . Unless the arts and manufactures be practically combined the unsuccessful aspirants after the higher branches of the arts will be infinitely multiplied, and the deficiency of manufacturing artists will not be supplied."

Having suggested that the proposed schools should receive pecuniary aid from the Government, if satisfactory evidence were given that the localities so assisted could supply a certain portion of the expense, the Committee laid stress on the importance of forming open Public Galleries or Museums of Art, seeing that our exclusiveness in this respect—for even Westminster Abbey and St. Paul's Cathedral could not then be inspected without the payment of vexatious fees—was held to be one reason for our want of taste. The Committee noticed with regret the neglect of any general instruction even in the history of art at our Universities and public schools; expressed an opinion that in order to extend the love and knowledge of art among the people, "the principles of design should form a portion of any permanent system of national education;" and also included in their suggestions amendment of the law of copyright.

The attention of the Government to the recommendations of the Committee was most prompt. Even before they had completed their labours, the Treasury had consented that a sum of £1500 should be included in the estimates for the establishment of a Normal School of Design, with a Museum and lectures; and on the 19th of December, 1836, the first meeting to institute proceedings was convened at the Board of Trade, the President of the Board (Mr. Poulett-Thompson) in the chair. A Committee having been appointed, consisting of Sir Francis Chantrey, R.A., and Messrs. Callcott, Cockerell, Eastlake, Ker, and Pellatt, to confer with Mr. Papworth (who it had been suggested should be the Director of the School), their labours resulted in a report setting forth the objects contemplated in its

operations,* and in the appointment, early in the following year, "of certain Royal Academicians and others interested in art as the Council of the Government School of Design," the members whereof were unpaid, and included amongst them the Vice-President of the Board of Trade, *ex officio*. On the 1st of June, 1837, the new School of Design was opened at Somerset House, in rooms formerly occupied by the Royal Academy. A female school was also carried on there until 1848, when it was removed to a house on the opposite side of the Strand: it subsequently found a home in Gower Street, where it was placed (in 1859) on the same independent footing as other schools, and it is still in active operation in Queen Square, Bloomsbury.

* It will be interesting to quote from this report the following passage:—

"The object of the proposed school is to afford the manufacturers an opportunity of acquiring a competent knowledge of the Fine Arts, as far as the same are connected with manufactures. To do this, it will require that the pupils should be taught not only drawing, but should be made acquainted with the principles and modes of changing and combining fine forms or ornaments, aided by light, shade, and colour, less by copying than by original arrangement and composition, adopting nature as the model, and the best works of established art in ornament as guides towards successful imitation. It is assumed that at present the comparative defect of articles, both of trade and commerce, arises from a general deficiency of taste in design and colour. As yet, the advantages of modelling are not sufficiently known by draughtsmen; this additional means of promoting excellence in design deserves adoption and encouragement, even in matters to which in this country it is not yet made subservient. To supply these should be the object of the school, and also to add the benefit of communicating a knowledge of the chemistry of colours, and to supply general information on the progress and advancement of the manufacturing arts, from as many sources as it can be obtained. The pupils should be capable of drawing accurately and with refinement, as the precursory qualification of its chief and ultimate object, which is the promotion of the art of design, or the power of forming combinations in ornamental art, which are endless, and altogether necessary to the exercise of fine fancy and sound judgment. It is by the exercise of these qualifications that the demands of the ever-varying fashions are to be supplied. It is necessary that the students should be confined within the objects of the school, namely, to amend and advance the interests of manufactures and ornamental trade." (Minutes of the Council of the Government School of Design, vol. i.)

MR. DYCE'S REPORT ON FOREIGN SCHOOLS.

In 1840 renewed attention was directed to the subject of art education by an exhaustive report prepared by Mr. Dyce, R.A., who, having become connected with the new School of Design soon after its establishment, was requested by the Council to go abroad to see the foreign Schools of Design and report upon them. He accordingly visited Prussia, Bavaria, France, and other countries, and in his report on the French schools made prominent mention of some points of distinction between France and England which may still be studied with advantage in this country:

"There is," he said, "no circumstance in France connected with the application of design, not merely to the silk manufacture, but to every branch of industry, that deserves more special notice than the high estimation in which industrial artists are held, and the free and unrestrained exercise of their judgment and taste which is consequently allowed to them in all matters over which their peculiar abilities ought properly to give them control. . . . A French pattern designer is looked upon in his sphere precisely in the same light as a professor of fine art. You may employ him or not as you think fit, but having given him a commission, it is he, not you, who is responsible for the merits of his performance; and this does not terminate in the design merely —his taste and judgment must be equally allowed to control the manner and process of reproduction."

Turning to the English side of this question, Mr. Dyce drew the following too truthful picture:

"For myself I am quite persuaded that if there is one cause more powerful than another which has contributed to retard, or which now presents an obstacle to the progress of taste in British manufacture, it is the degraded position which pattern designers occupy—a position in which their talents find no scope for development, and their taste and judgment as artists are set at naught. It may appear incredible, but I assert it without fear of contradiction, that there are few, if any, instances in Great Britain of industrial artists who are employed as responsible persons; that is, to whose judgment manufacturers give the least deference, whose productions can be looked upon as original works, or who are allowed even to have a voice as to the mode in which the patterns they are employed to make should be executed. This state of things, it is true, in the first instance originated in the deficiencies of designers themselves, and their inability to cope with the skill of continental artists; but the position they have lost cannot

now be regained solely by the acquisition of any degree of excellence, since the expedients universally resorted to by manufacturers have done away the necessity of other than mere draughtsmen and copyists. As the case now stands, the manufacturer takes upon himself the onus of finding the pattern, and this is every way attended with detriment to the interests of commerce."

Having observed that, generally speaking, manufacturers were practically unacquainted with art, and that they therefore took upon themselves a responsibility which, from their education, their occupations, or perhaps their natural powers of judgment in matters of taste, it was impossible that they should be competent to discharge, Mr. Dyce went on to say:

"The mechanical business of copying, altering, or dovetailing patterns, already in some shape in the British or foreign market (which is all that a draughtsman is now called upon to do), is neither lucrative, nor does it hold out the very smallest prospect of that kind of reputation and applause which French designers individually enjoy, and which every one knows is the most powerful motive for exertion with young artists; the consequence is that, if a youth of natural ability thinks he has any prospect whatever of succeeding in the higher walks of art he will rather take his chance in this than submit to the thankless drudgery to which he is exposed as a pattern draughtsman. If this is not true, how comes it that we have no instances of men of high artistical powers devoting themselves to design for industry? That such is the case in France every one is aware; and why is it so? Because not only is the estimation in which they are held, and deference which is paid to their opinion, always proportioned to their skill and abilities, but the remuneration is such as to insure them a respectable position in society. In Lyons the commercial value of taste is reckoned so high that, when a young man displays remarkable powers, a house will admit him to a partnership, in order completely to monopolise his services. Even in general employment a Lyonnese pattern designer in good practice realises as much as 10,000 f. per annum, which, considering the comparative value of money in Lyons and any town in England, must be reckoned a sum much beyond the conceptions of remuneration on the part of English manufacturers. But why is this? For this obvious reason. The French manufacturer incurs little or no expense for the purchase of foreign designs; he does not employ agents to obtain, *per fas aut nefas*, a pattern of every new article that appears in the London or Paris market; he never suffers the loss (so frequent in this country) arising from his having manufactured the same pirated design simultaneously with three or four other houses; and therefore it is that he

can afford to pay his artist highly. Though the sum he thus expends may appear large, the outlay on patterns in France is not greater than it is in England, if, indeed, it be so great. But the difference is this, that the money which in France is paid directly to the artist is in England frittered away on expedients for superseding the employment of original designers—expedients which, if law and honesty are to be taken into account, cannot be reckoned other than illegitimate, and which in prudence must, I fear, be thought very short-sighted; because the great bulk of the patterns executed in England according to the present system must inevitably want the stamp of novelty and originality, which is not only the great characteristic of the French, but is really the advantage which the French manufacturer gains by paying liberally for the assistance and judgment of highly educated artists."

Mr. Dyce then proceeded to notice another evil arising from the system then in vogue in England—the want of artistic taste in the execution of fabrics, especially of the coloured kinds:

"It is," he said, "the common practice to ring the changes (if I may use the expression) on a pattern, by varying the arrangement and quality of the colours. I need not say that to do this in a tasteful manner the judgment of an artist is absolutely necessary. Now, unfortunately, this is never (so far as I have been able to learn) put in requisition. Nominally, it belongs to the manufacturer to direct the variations of colour and effect, but virtually it is left to ignorant workmen, who, having a certain established mode of proceeding, put it in practice in every case, whether in respect of taste it be right or wrong. A few years ago a French manufacturer of paper-hangings came to this country with the intention of commencing business. To ensure his success he brought with him a skilful designer of patterns, believing that with the advantages he should enjoy in other respects he had only to superadd the quality of excellent design (in which English papers are lamentably deficient) to drive all competitors out of the market. He engaged English workmen, and commenced his operations. His designer, accustomed to the French method, was, of course, not content with having merely furnished the pattern; he considered that half of his vocation consisted in seeing that no injury was done to the character of his designs through the unskilfulness of the workmen. With this view he insisted that the tints employed should exactly correspond to those in his design, and that if the colouring were to be changed the alteration should be according to his judgment. Could anything be more reasonable? But what was the result? The workmen struck work; they had been accustomed to make up their tints in large quantities, they had never used but three greens, or two reds, or two yellows, and so on; there were only certain changes in the

arrangement of the colours which they were in the habit of making, and it was absurd to suppose that they should submit to the caprice of a Frenchman, who seemed to think there were as many colours as days in the year, and who insisted upon many minute variations of tint of which they could see no use, and which were not employed in the trade. The concern was accordingly broken up. I have mentioned this little history (which is purely matter of fact) not only because it completely marks the difference between the French and the English system of *mise en fabrique*, but because the comparative results which might be expected from the difference are so fully borne out by the actual state, in the two countries, of the branch of industry to which it relates. Half a century ago, I am informed, France was supplied to a large amount with paper-hangings manufactured in England, and the names of the artists who at that period gave to it its high character have even been preserved. At the present time . . . . the importation has dwindled down to almost nothing; while a visit to the shops of any of the English dealers in the metropolis will prove to what extent England is indebted to France for whatever is novel or tasteful in this branch of industry."

In answer to the question, "Do the foreign schools, either singly, present a model which it might be safe to follow in organizing the Government one at Somerset House; or, collectively, do they exhibit any common character or principle which would seem to determine the precise character of the instruction which is required for the education of designers for manufactures?" Mr. Dyce observed:

"Putting the matter in the former light, it does not appear that there is any one of the establishments I have visited that exactly answers to the proposed nature of the school lately founded under your auspices; the Prussian and German schools being, on the one hand, more extended, and the French, on the other, more limited in their purposes, than is consistent with the objects you have in view. But if the inquiry be regarding the principle on which the study of design for industry ought to be conducted, all the schools seem to me to offer the same testimony. If the school of Lyons were supposed to bring within its scope the whole circle of manufactures, instead of confining itself merely to the improvement of fabrics of silk, and to employ means of instruction in design for industry generally, on the same principle as it now acts upon in reference to silk manufacture, its plan would be absolutely identical with that of the Prussian and Bavarian schools, supposing these latter to be stripped of the branches of study which have no immediate bearing on design. Thus, in the school of Lyons we have—1st, the general study of design; 2nd, the study of the process and reproductive

capabilities of the manufacture to which design is to be applied; 3rd, the study of the particular species of art rendered necessary by the conditions which these impose upon the artist. It is obvious that, however extended the purpose of the school may be, these three branches of study must, in some shape or other, be brought into operation . . . . The art to be learned is not that of producing an abstract kind of decoration adapted to no particular purpose, or an eternal ringing of the changes on the few ornaments of Greek architecture, but the best mode of designing patterns suited expressly to particular fabrics or manufactures. Design and manufacture are the elements which are to be brought together; they must, therefore, equally form matter of study in the school. On the one hand, the study of art is necessary, because this is the remedy to be applied to bad taste in manufacture; on the other, the study of manufacture is not less so, because, without this, how is it possible to know in what way the remedy is applicable? . . . . The foreign schools of design deal with artists or designers (*i.e.* inventors) as if they were to become workmen, and with the workmen as if they intended to be artists; the designer is brought down to the level of the workman by the practical study of industry, and the workman is elevated to the level of the artist by the study of art . . . . To effect this, we find in all the schools an apartment for the practical study of industry, termed in the Prussian and Bavarian the *werkstadt*, and in the French the *atelier;* and I do not see how the Government school can answer all the ends for which it has been established without the help of a department of instruction of this kind. In recommending, however, the provision of apparatus for the study of manufacture as quite indispensable, I must not be supposed to contemplate anything like the extent of that employed in the German schools. In these the purpose is to teach the practice of mechanics generally, and the history of machinery, whether with or without a reference to design; but in the Government school it is in the latter relation only that the study of industrial processes must, in my estimation, form part of the exercises. The processes, it is true, are few in number which present any difficulty to a designer; but it happens that the very manufactures to which the school is intended especially to apply are the most complicated of any; I mean the silk manufacture and calico printing, with which I am sure I am warranted in saying that it is utterly impossible to become familiar otherwise than by practice."

THE SCHOOLS OF DESIGN.

A School of Design having been established at Somerset House, as the first result of the Committee of 1835–6, it was proposed that instruction should only be given from ten in the morning till four in the afternoon, but before long a

class was also started for the accommodation of evening students. The instruction was divided into two sections—1, elementary, including outline drawing, shadowing, drawing from plaster, modelling, and colouring; 2, instruction in design for special branches of industry, including (*a*) the study of fabrics, and of such processes of industry as admit only of the application of design under certain conditions; and (*b*) the study of the history of taste in manufacture, the distinction of styles of ornament, and such theoretical knowledge as was calculated to improve the taste of the pupils, and to add to their general acquaintance with art. The Council formed for the provisional government of the school did not, however, think it expedient to introduce the practical study of any manufacture but that of silk, for which they provided a loom and Jacquard machine, and other necessary apparatus, and procured the assistance of a teacher, who for a year gave instruction twice a week in weaving and in the application of design generally to the fabrics of the loom. This class, however, the Council found it expedient to discontinue, the numbers attending it being so small as scarcely to warrant the cost of tuition.

In 1840 the Government decided to extend their assistance to the manufacturing districts, and authorised a grant of £10,000 towards the formation and outfit of Schools of Design in the large towns. The fund was "to be devoted to the tuition and payment of teachers, the purchase of casts, and the preparation of models for the use of the schools;" a further grant was also contemplated, and the inducements held out by the Government soon resulted in the formation of schools at Birmingham, Glasgow, Manchester, and York, besides which a branch metropolitan school was established at Spitalfields.*

* A Normal Class was also proposed, to consist of six students, to be selected after a probation and competition of three months; and the students selected were to hold six exhibitions of £30 a year each for three years, if found necessary. The formation of the probationary class was advertised, and the terms of the competition stated. This class was formed on the 1st November, 1841, of senior students already

It may be mentioned incidentally that about this time considerable impetus was given to English art by the rebuilding of the Houses of Parliament. In April 1841 a Select Committee of the House of Commons was appointed "to take into consideration the Promotion of the Fine Arts" in connection with that work. The Committee, in

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in the school who desired to enter it, and of candidates selected in accordance with the regulations, who submitted suitable works for approval, and presented testimonials as to character, &c. At the expiration of the three months the first six exhibitions were awarded to Mr. H. Durrant, afterwards appointed Head Master at Sheffield; Mr. George Lambert, subsequently appointed to York; Mr. Richard Norbury, who resigned his exhibition at the end of the first year, to take the mastership of the evening art classes at the Mechanics' Institution, Liverpool; Mr. J. Patterson, who succeeded Mr. Lambert, after his death within the year, at York; Mr. George Thompson, the first Head Master at Nottingham; and Mr. George Wallis, appointed to Spitalfields, subsequently to Manchester, and some years later to Birmingham, now Keeper of the Art Collections, South Kensington Museum. This Normal Class existed little more than a year, as the then Director, Mr. William Dyce, who subsequently became a Royal Academician, considered its members qualified for their work. All the first appointments mentioned were made before the middle of February 1843. A second Normal Class was formed in May 1843, consisting of Mr. Denby, subsequently a teacher at Somerset House, Marlborough House, and South Kensington; Mr. Evans, appointed to Coventry; Mr. Adam Findon, Assistant Master at Manchester, where he died; Mr. James Kyd, many years Head Master at Worcester; Mr. Kingford, who never appears to have received an appointment, owing to lameness from an accident, but who assisted at Somerset House; and Mr. Silas Rice, appointed Assistant Master at Manchester, and subsequently for many years Head Master at Stoke-upon-Trent. Before any of the members of the second Normal Class were qualified for an appointment, a Head Master was wanted for Birmingham, and Mr. W. C. T. Dobson, now a Royal Academician, who had been a student in the school at Somerset House, and left it for the Royal Academy Schools, was selected and appointed. After the appointment of the members of the second Normal Class, as above detailed, the system was adopted of selecting artists willing to pass a short probationary period in the school at Somerset House, and as masters were required they were appointed. This, however, resulted in very varied success as to the character of the instruction given in relation to decorative and industrial art, and ultimately led to changes in the whole administration of the schools.

their report, expressed an opinion that an opportunity was afforded for the encouragement, "not only of the higher, but of every subordinate branch of Fine Art," and in the following November a Fine Arts Commission, with the Prince Consort at its head, was nominated to carry out this object. The mode in which it was accomplished may be seen at Westminster.

In 1842 the Board of Trade reconstituted the Council of the Government School of Design, increasing the number of members to twenty-four, and placing the school under the management of a Director controlled by the Council, which body was itself to be controlled by the Board of Trade. This, however, was a cumbersome piece of machinery, necessarily involving a good deal of friction, and owing to this and other reasons the influence of the schools was in their early years inconsiderable. From the first their specific object—to influence and improve ornamental design in manufacture—appears to have been clearly apprehended and distinctly avowed, but the *modus operandi* was not successful. From time to time manufacturers and others purchased designs produced by students in the performance of their exercises—indeed, a constant advance in this respect was evident—but students found themselves unable to obtain employment as ornamental draughtsmen and designers owing to their want of technical information, and the manufacturers were indisposed to afford them facilities for acquiring it. Much talent available for the industrial arts was accordingly diverted to the pursuit of fine art, and it became clear that the schools were not working satisfactorily.

This being so, in November 1846 a Special Committee of the Council of the Government School of Design was appointed, under the chairmanship of Mr. J. G. Shaw Lefevre, to consider and report upon its management, and outspoken letters written by Mr. Redgrave, Mr. Ambrose Poynter, Inspector of the Provincial Schools, Mr. R. Burchett, a former student and subsequently Head Master of the National Art Training School at South Kensington, were

submitted to the Committee, in which the latter complained that elementary instruction was all that a student could obtain at the school at Somerset House, which as a School of Design was "an utter and complete failure," for "instead of any attempt being made to teach the principles of any style of ornament, the only principle acted upon is that of continual copying;" whilst Mr. Poynter said that the provincial schools had "no pretension to be called Schools of Design," and added, "No element of Art culture beyond the imitation of form and colour has ever been introduced into their system, except at Manchester, where the late master, Mr. Wallis, lectured on the history and principles of ornamental art." The Committee, in their report, said that though they thought the advantages of the school were somewhat underrated, they could not regard the instruction, which appeared to be neither general nor systematic, as the whole which ought to be given in respect of ornamental design. They therefore thought an attempt should be made to devise "a systematic and complete course of instruction, which should embrace the theory and principles of ornamental design (including the history and explanation of the different styles) and the application of those principles to the various kinds of manufacture, to the end that the power of making original designs may be acquired by the pupil, and may be exercised by him, whilst in the school."

In the spring of 1847, at the personal request of the Earl of Clarendon, President of the Board of Trade, Mr. George Wallis met Mr. J. G. Shaw Lefevre, Secretary to the Board, for the purpose of considering the condition of Schools of Design, and was requested to prepare a systematic statement of his views of a comprehensive system of instruction. The result was the chart given in Appendix A.

In June 1847 a second Special Committee of the Council, with Mr. Monckton Milnes as its chairman, was appointed to report to the Board of Trade as to the best mode of carrying out the recommendations of the previous Committee, and formulated a new scheme, of which the

following are the most important features:—That a Committee, to be named the Committee of Instruction, should be appointed by the Board of Trade, from the Council, to consist of five members, three at least of whom shall be artists by profession; that this Committee should have general superintendence of the method of instruction pursued in the schools, and that their decisions should not require confirmation by the Council. That the business hitherto assigned to a Finance Committee should be transferred to a Treasurer, and that hitherto assigned to a Correspondence Committee to be divided between the Director and the Secretary; that the course of instruction in the head school should include three classes: for form, colour, and ornament; that each should have a professor at its head, with requisite masters; that the professor should be appointed by the Council on the recommendation of the Committee of Instruction, the masters to be similarly appointed, after consultation with the professors; that the professor should be solely responsible to the Committee of Instruction for the arrangement and progress of his class, and the masters responsible to their professor. That each professor should lecture to his class at least once a week, and that courses of special lectures to the whole school should be given on anatomy, botany, perspective, and the history, principles, and practice of ornamental art; that in the branch schools the method of instruction should be assimilated to that laid down for the head school; and that increased accommodation should be provided at Somerset House.

These recommendations, with some slight modifications, were acted upon without delay. The Council was dissolved in April, 1848, by a minute of the Board of Trade, and the directive power was assigned to a Committee of Management, consisting of Sir R. Westmacott, R.A., Mr. Geo. Richmond, Mr. Ambrose Poynter, Mr. J. G. Shaw Lefevre, Mr. (now Sir) Stafford Northcote, and the Joint Secretary for the time being of the Board of Trade, the first three representing the artistic, and the others the

official element. The executive power as to the educational business of the head school was confided to three head masters, Mr. Townsend (form), Mr. Horsley (colour), and Mr. Dyce, R.A. (ornament). The official business and details non-artistic, previously assigned to the Director, were committed to the resident Secretary, Mr. Deverell, and the services of the Director, Mr. Wilson, were transferred exclusively to the provincial schools. The beneficial effects of these changes, managerial and instructional, was manifest in the increased attendance of young men engaged in pursuits requiring the application of art to industrial purposes, and in the numbers seeking admission to the schools, of which there were now fourteen, in addition to the central schools in London. The Parliamentary estimate in aid of their support for the year ending March 1849 amounted to £10,000, of which £3500 was for the school at Somerset House and the Female School in connection therewith. These were supported wholly by the Government grants and students' fees; the Spitalfields and provincial schools, partly by Government grants, partly by local subscriptions, usually of the same amount as the grants, and partly by students' fees. The aggregate amount of the Parliamentary grants, since 1835, was £55,278; the receipts from fees at the head school, £3064, and at the country schools £5362; and the local donations and subscriptions £17,110; making a total expenditure of £80,814, which would give an average cost of about £5 4*s.* 3*d.* for each student, reckoning the total number of those who had at some time been under training at 15,500.

SECOND SELECT COMMITTEE OF THE HOUSE OF COMMONS.

The time had, however, arrived when the whole subject of education in industrial art again demanded thorough investigation, and in June 1849 a second Select Committee of the House of Commons, of which Mr. Milner Gibson was chairman, was appointed "to inquire into the constitution

and management of the Government School of Design, and to report their opinion thereupon." The Committee examined a number of witnesses, including Mr. Stafford Northcote and Mr. Ambrose Poynter, members of the Committee of Management of the Schools, the Secretary (Mr. Deverell), most of the masters at Somerset House, eighteen manufacturers and designers from various parts, and others connected and unconnected with the schools.

The evidence was almost uniform on one point—as to the national importance of Schools of Design, and even those who did not consider them to be in a satisfactory condition were, with scarcely an exception, ready to admit the value of such institutions to the manufactures of the country. Moreover, it was urged by various witnesses—amongst them one who was fast making his way to the front rank as an ardent pioneer in this great work, Mr. Henry Cole—that as experience of the past showed that the English people could do most things as well as foreigners, their cultivation in industrial art might be pursued with confidence as to the result. In the course of his evidence, Mr. Cole handed in a paper containing a series of suggestions (in which technical education is distinctly recognised) for the future management of the School of Design. (See Appendix B.) The inconvenience of placing a Committee of Management, variously composed, between the Board of Trade and the Masters of the school at Somerset House was indisputable, and the existing system of control was generally condemned. The importance of appointing designers rather than artists as masters was also dwelt upon, for it was admitted by Mr. Dyce and Mr. Herbert, themselves Royal Academicians, that a good artist was not necessarily a good designer, and might be incapable of teaching what was required. The condition both of the central and the provincial schools was complained of, and the Manchester school (which had greatly declined since the resignation of the late master), was described as "nearly useless" to those for whose benefit it was designed, but its condition could not be taken as a criterion of the general state of the schools.

Indeed, it was stated that at Nottingham no designers obtained so much as the pupils of the school, who had the command of the market for lace designs. Some of the appointments to masterships were also regarded as unsatisfactory, and it was stated in one case that a master who understood the application of design to the manufacture of the locality had been removed to be superseded by one who knew nothing of its requirements. Many witnesses were of opinion that elementary knowledge was more efficiently imparted than before, but on this point there were controversial differences between the Masters and the Committee of Management. It was urged that there was too great a tendency towards instruction of a general character, more suitable for the artist than for the art-workman or designer, and Mr. Herbert (master of the class of ornament) objected that figure-drawing and the use of colour were unnecessary to many students, whilst Mr. Northcote contended that it was of great importance, in order to enable the student to draw perfectly well, and that it had a direct bearing on ornamental design, a view in which Mr. Poynter concurred.

The principles avowed in 1843, that "all the exercises of the pupils should have reference, even from the commencement, to ornamental design," had been to some extent departed from, for it appeared from a return relating to the class of ornament that the attendance had not exceeded 15 students per month, out of an average attendance of 289. Mr. Northcote, certainly not an unfavourable witness, while of opinion that a great step had been taken towards introducing the teaching of design, was fain to admit that the system fell short of the original purpose for which the schools were instituted, and that the instruction given was more elementary than was intended. It also appeared that nearly every school was in debt, which was partly ascribed to the commercial distress which had prevailed, and partly to the fact that many manufacturers, who had subscribed for a specified period of three years, now declined to subscribe any longer. Indeed Mr. Poynter admitted that the schools were not supported with much

interest either by manufacturers or artizans, and it was stated that owing to pecuniary and other reasons the latter did not remain long enough in the schools to receive their full benefit, being drawn off to Fine Art on the one hand or to manufactures on the other. Though there was some difference of opinion as to whether the schools had had any effect on the manufactures of the country, it was stated by several witnesses that a great improvement in design was observable at Birmingham, Sheffield, and elsewhere, and it is but reasonable to suppose that the teaching imparted at the schools—almost the only means of educating the public taste—had had its effect, though it might be difficult to trace it. At the same time there was a good deal of testimony to show that the schools had had less direct influence than had been anticipated, for Mr. Cole admitted that of 56,000 designs registered since 1839, probably not more than 100 could be selected as manifesting improvement of an original character, the best appearing to be adaptations of foreign originals. It is, perhaps, more to the point to state that, in reply to a circular letter addressed to those who had been accustomed to register the greatest number of ornamental designs, answers were received from 41 extensive manufacturers, of whom 26 were employing students from Government schools, and of 829 persons returned by these firms 148 were in attendance at the schools; but it should be added that of the total number of 829 no fewer than 473 were connected with the firm of Messrs. Minton and Ridgway, in the Potteries, and 144 belonged to places where there were no schools. It appeared that the practice of copying or adapting foreign designs still prevailed in all classes of manufacture, and although the manufacturers, generally speaking, did not welcome the schools as a means of putting an end to a state of things fatal to the attainment of any pre-eminence in decorative design, the position was recognised in all its gravity by some of the most enlightened amongst them. Mr. Herbert Minton, for example—who spoke without reserve of the beneficial effects of the schools in the Potteries—said, in answer to a

question: "Our success, I may say our salvation as manufacturers, depends upon the School of Design being well carried out, and communicating sufficient artistic knowledge." Mr. Northcote stated that the schools were regarded with a good deal of jealousy by some large manufacturers, who could afford to give £200 or £300 a year to a designer, lest the schools, by raising the character of designers generally, should enable smaller men to compete successfully. The bad taste of the public was also a great hindrance to the work of the schools, for frequently the most tawdry designs were the most popular, whilst the manufacturer was too apt to care very little for beauty of design so long as he could produce what would sell, and did not hesitate to mangle at his will the conceptions of the designer, although unable to judge of their artistic merits. It was very forcibly observed by one witness that many of the masters wanted training as much as the operatives, and an example of this will be found in the following passages from the evidence of a Scotch manufacturer:—

What do they teach in the —— School of Design?—I believe the highest branch is sculpture, and in making faces and so forth; what they call the Fine Arts. I do not see at all how it is to benefit us.

Do you think that the knowledge of drawing that they obtain there would not be beneficial to you?—No; but I think if they were put into a botanical garden, and left to go among flowers and trees and so forth, it would be a very great privilege for them for their mind to be exercised in the study of any sort of pattern.

You think that the sort of instruction they receive in the School of Design does not make them at all better qualified to work in your business?—No, the reverse. For instance: now if a young man goes into a place where there are a great many statues; there are men, feet, and other things disagreeable to look at. It is nothing uncommon to see the half of a man's face stuck upon a wall. I have seen a large horse's head stuck up in a very prominent place for people to draw from. I cannot see, in the nature of things, how these things can improve a man's taste; it takes away the beautiful ideas from a man who is going to draw patterns; I have put a variety of things into shawls, such as men and animals, but I assure the Committee that they were always a losing concern whenever I attempted anything natural.

You do not think that an individual drawing from these odd figures would acquire a great facility in sketching?—No, I do not; I think it

takes away any sort of ideas a man has. For instance, if you look at the Schools of Design in France, and there are a great many (about 100) of them. Sculpture is but a secondary thing with them, with us it is the first and principal thing taught.

You have been in the Schools of Design in France?—No, but I have spoken to men who have been there.

* * *

What amount of subscription was raised in —— for the School?—I do not know; when I was asked for a subscription I said, "No; the thing would never do any good, and it was no use to give away any money to a thing that would result in nothing."

In fact, personally, you know very little of the School of Design?—I know a great deal; that is, all the practical parts of it.

Have you visited it frequently?—Only once; that is quite sufficient for any practical man; he does not require to go month after month to see the workings of the thing.

How long were you there when you visited it?—About half an hour.

* * *

What did you see in —— School?—There were about from 12 to 20 young men, I think, from 10 to 18 years of age, learning to draw from a sketch, rough sort of sketches, architectural drawings, and in statuary; some of them were drawing heads and arms and so forth, which I do not think can improve the taste of anybody.

* * *

Have you attended any of the lectures?—No; I know perfectly well what they would have said (the same as other people say) on the Fine Arts, and the advantage that Schools of Design would be to the country, and so forth. That is what they all say; but these advantages have to be realized, the same as the advantages of free trade have to be realized; yet I suppose we shall have them both by-and-by.

This, no doubt, was an exceptional instance of the prejudice and hostility with which the Schools of Design had to contend in the earlier stages of their growth, but the difficulties arising from the attitude of the less enlightened manufacturers are not wholly disposed of even in our own day. The evidence of this "practical man" was controverted by another witness from the same town, who declared himself astonished at the good results arising from the tuition given in the school, whilst a third also expressed a favourable opinion of its work. It must, however, be admitted that the schools had not, up to this time, produced any decided impression on art-industries

generally, either in execution or in the creation of original designs, which still had to be sought in France, and therefore they had fallen short of their original purpose.

In July 1849 the Committee agreed to a report in which they said :

"From a general review of the evidence, your Committee conclude that the schools, though far from having attained the degree of perfection of which they appear capable, are producing beneficial effects, and may in due time be expected, with energetic support and under judicious management, to realise the anticipations with which they have been founded. In an undertaking of so novel and experimental a character difficulties have arisen, and no doubt errors have been committed. Prejudices have been encountered; it has been found difficult to get men duly qualified in all respects for the duties which they have had to discharge; and, finally, there have been many differences of opinion among those who have been charged with carrying out the undertaking, which have necessarily impeded the uniformity of its operations. Your Committee cannot flatter themselves that these difficulties are yet at an end, but they see reason to hope that they are gradually disappearing, and confidently recommend to the House to continue the support which has hitherto been afforded to an object of such great national importance. Your Committee believe that, large as the field of usefulness appeared when these schools were established, it has been found by experience to be very much larger than was at first anticipated. As the managers of the schools have proceeded, they have found work grow under their hands. For the teaching of ornamental art necessarily presupposed the students having attained to a certain proficiency in elementary studies, and this proficiency few, if any, were found to have acquired, so that it has been necessary to impart it at the beginning of each man's education. The demand for such teaching has been so great in proportion to the means which the schools possess of supplying it, that they have of necessity assumed more of the character of elementary institutions than was originally expected. The importance of this sound elementary grounding has not always been comprehended, and too great anxiety has been shown in some cases to reap premature fruits of the schools; but your Committee believe that what has been done in this direction has been of great importance, and that, under all the circumstances of the case, the managers have been right in endeavouring to raise the taste of the great mass of artizans, rather than by special efforts to force on a few eminent designers."

In answer to the complaint that the schools were not sufficiently practical, the Committee said that in their view

the schools were educational institutions, and their main object was "to produce not so much designs as designers." The education of a designer was, however, a slow process, and could not in many instances be carried to perfection without the technical experience gained in the manufactory. Therefore, to expect that a student would, on leaving a School of Design, be able immediately to produce superior designs, was to expect an impossibility; but it might be safely affirmed that the 15,000 or 16,000 students who had passed through the schools since their commencement had exercised more or less of a beneficial influence on manufactures. At the same time the Committee were of opinion that much remained to be done, in order to bring the schools fully to bear upon the manufactures of the country and the higher branches of design. Having remarked on the inconveniences of the existing mode of governing the schools, the Committee could not avoid expressing the opinion that the Committee of Management ought not to be retained, and that the principles of management should be these: that the supreme executive authority should be vested in the Board of Trade, and that all persons employed should be immediately responsible to that Department; that the Board should appoint all masters, &c., and that one or more paid inspectors, acquainted with ornamental designing, should visit and report upon the provincial schools, but should not be authorised to interfere with the details of the teaching, for which the head masters ought to be solely responsible. The Committee further recommended that, in the appointment of masters, care should be taken to select men who were practically acquainted with designing; that the connection between the head school and the provincial schools should be strengthened, by bringing a certain number of advanced students from the latter to finish their education in London; and that Mechanics' Institutes and other institutions where elementary drawing was taught should also be brought into connection with the system. As the grant of £10,000 made in 1840 for the outfit of the schools was now exhausted, the

Committee strongly recommended a further grant for the same purpose; and as it did not appear that they could for many years become self-supporting, they urged upon the House the necessity of increasing the annual grant in aid of their maintenance—inadequate means being regarded by them as one of the main causes of the comparative inefficiency of the schools—but that the principle adopted in 1835, of making the Government grant depend upon the voluntary subscriptions for the branch schools, was sound and ought to be maintained. This principle, it may be added, has since been abandoned as impracticable.

INSPECTION OF THE PROVINCIAL SCHOOLS.

As a step towards the accomplishment of these changes, the Board of Trade desired (in November 1849) that Mr. Herbert, R.A., Mr. Redgrave, A.R.A., and Mr. Townsend, as joint Head Masters of the School at Somerset House, "should undertake the entire conduct of the school, with direct responsibility to the Board," and should make such arrangements in all respects as they might think necessary, having full authority over the other masters in the school. In the following month, in compliance with instructions from the Board, these gentlemen made a report on the productions of the provincial Schools of Design, and stated that they found, with scarcely a single exception, "an absolute want of the application of elementary teaching in the production of design," though in other respects much of the work presented received commendation. Indeed, the results in design, as applied to local manufactures, were said to be more numerous from the Spitalfields school than from all the provincial schools put together. About the same time Mr. Ambrose Poynter (who was in the following July formally appointed Inspector of the provincial schools) visited Manchester, Birmingham, Coventry, Nottingham, Norwich, Sheffield, and other places, and made a series of reports, in which he stated that at Manchester the manu-

facturers were still slow in coming forward to support the school, but "the vulgar and pernicious error" so generally entertained by them, as to its becoming a market for patterns, was wearing out, and the practical advantage of the school was making itself abundantly manifest. Manufacturers who, competing with the French in the American market, had been under the necessity of employing foreigners, not only to sketch their designs, but also to draw out their patterns, were now able to produce better patterns at far less cost by means of their own apprentices educated in the school, whilst these obtained higher wages than had previously been paid to the same class. At Norwich the connection of the manufacturers with the school had nearly ceased. They had no faith in the common advantage to be derived from the general improvement of draughtsmen and artizans, but expressed disappointment at not being able to obtain cheaper and better designs; and it was, therefore, but natural that designers and others concerned in preparing patterns should dislike the school and avoid it, under the apprehension that pupils might there learn to supplant them. At Sheffield the manufacturers were "beginning to suspect their own ignorance of art, and that some advantage might be made of a better acquaintance with it." Nothing, Mr. Poynter said, could be worse than the current taste in Sheffield goods, and the predominant feeling on the part of stove-grate makers and others was, that "as long as they could make what would sell it was better to try no new experiments." * The art taught in the Sheffield school was, however, gradually and surely penetrating into the manufactories, where the best pupils were engaged, and there were already many "little masters" who had been educated in the school.

* At about this time it was the common practice of a leading Sheffield manufacturer, in order to avoid the expense of new dies for his teapots, to turn the design upside down, with the exception of the base and the top, in order to produce a new pattern for the market.

In another report made to the Board of Trade in July 1850, Mr. Poynter said:—

"Of the three classes of persons with whose interests the schools are most immediately connected—1st, the manufacturers; 2nd, the established designers and draughtsmen; and 3rd, the rising generation looking forward to the exercise of industrial art—the former perhaps have the least appreciation of the legitimate objects of the schools. One of the most formidable obstacles with which the infancy of the schools has had to contend, has been the total misapprehension on that point by the great bulk of the manufacturers, and their erroneous expectations of what the schools were to perform; that they were to be markets for designs; that the boys attending the classes were at once to become designers, and that the schools were to furnish the pupils with all that long experience which an intimate acquaintance with the conditions of art-manufacture can teach, in less time than is necessary to master the elements of drawing. But that such notions should prevail, both among those who were expected to encourage and support the schools, and those for whose education they were intended, is not surprising when it is considered that down to the establishment of the schools the population of the seats of manufacture were utterly destitute of the means of acquiring the instruction in art by which alone errors so pernicious can be counteracted, and that the schools were indispensably necessary to create, in the first place, the intelligence through which alone they could be properly valued, and efficiently supported and developed. Nor is it in the power of those manufacturers who form an honourable exception, and by whose contributions and exertions the schools are supported, to force from them results which time alone can produce. Any attempt at a premature development of the schools must not only prove a failure, but must materially retard their progress. . . . That a more just appreciation of the schools is gaining ground is not to be doubted, but a faith in a common advantage to manufacturers from the general education of designers and artizans, and in the disinterested motives of those by whom it is advocated, will be slow of growth; and in the meantime the schools must be maintained, unless a national system of art-education is to be abandoned just as its influence is beginning to be felt and acknowledged."

At this time there were 16 provincial schools in Great Britain and Ireland, and a total of about 3000 pupils under instruction, a considerable proportion of them in the elementary stage. In Mechanics' Institutions, and other establishments for promoting education among the working population, drawing classes were also gaining ground, and

Mr. Poynter urged that "nothing would promote the objects of the Government Schools of Design more effectually than to extend the study of drawing to the whole system of national education, by the general establishment of drawing classes (of course, of the most elementary character possible) in the national schools." In concluding his report, Mr. Poynter observed that the progress of the schools must be slow, for it involved no less than a national progression in art:

"Until," he said, "time has elapsed for a new generation of artists and designers, adding experience to knowledge, to be met by a new generation of manufacturers possessing a due appreciation of art; until artistic knowledge and skill are thrown into the market in an abundance which will force them into the channels of industrial art and of a quality to dissipate the notion that the meanest portrait painter is better than any designer for manufacture, the schools cannot produce their ultimate results, and an unreasonable and unreasoning expectation of what they are to perform in the meantime is the greatest danger they have to encounter."

EXHIBITION OF THE WORKS OF STUDENTS AT MARLBOROUGH HOUSE.

In the spring of 1851 a public exhibition of the works of the students—a marked event in the progress of the Schools of Design—took place in the rooms of Marlborough House, the use of which was granted for that purpose. The extent and excellence of the work done at this time is shown by the circumstance that room could only be found for little more than one-fourth of the examples considered worthy of exhibition. Of 7571 works produced in the head school during the previous twelve months, and sent in for exhibition, 1584 were selected, and of 2332 works from the branch schools 1057 were selected, making a total of 2641 works arranged in 24 classes, from the most elementary studies to the most advanced. The branch schools represented in this display were those of Belfast, Birmingham, Coventry, Cork, Dublin, Glasgow, Hanley, Huddersfield, Leeds, Manchester, Newcastle, Norwich,

Nottingham, Paisley, Sheffield, Spitalfields, Stoke, and York, and the exhibition included 708 original designs, of which more than two-thirds were from the students at Somerset House. The drawings, &c., produced were essentially the work of the artizan class, and to a very large extent of those engaged in occupations which admitted of their obtaining instruction in art during the hours of evening relaxation only. The joint report of Mr. Herbert, Mr. Redgrave, and Mr. Townsend, on these productions states that they displayed a general and marked improvement in almost all the schools, and greater attention to a sounder and more careful elementary teaching, while in some an increased consideration of the local manufactures to be aided by their means was beginning to be evinced, and objectionable modes of study complained of in previous reports, where not entirely removed, were gradually giving way to more satisfactory methods. It is deserving of especial mention, as additional evidence of the training imparted at this time, that one of the exhibiting students, Mr. T. S. Bell, who held an exhibition at Somerset House, was selected by the Trustees of the British Museum to proceed to Nineveh to make drawings of the work brought to light by the excavations superintended by Dr. Layard. It should also be mentioned that in 1850 two exhibitions of £40, one of £20, and two of £10, were established to enable designers dependent on their daily labour to remain long enough in the school to reap its full advantages, and these had material effect in developing the powers of promising students.

THE GREAT EXHIBITION OF 1851.

Amongst other matters referred to the Select Committee of 1849, whose work is reviewed in the foregoing pages, was a petition from the Council of the Society of Arts, praying the Government to permit the use of a public building for the purposes of a national exhibition of manufactures, to be held every five years. Several

witnesses were questioned touching this project, and they were agreed as to the advantages which the decorative manufactures of the country were likely to derive from it. Mr. Henry Cole gave evidence as to the progressive successes of annual exhibitions of this kind which had been held under the auspices of the Society of Arts, and stated that they had now become a source of income to the Society, after paying all expenses; and the report adopted by the Committee mentioned national exhibitions of manufactures and annual exhibitions of the work of students as matters deserving of attention. The latter suggestion was carried out by means of the exhibition at Marlborough House, just referred to, and the former idea took root and fructified, until in 1851 it expanded, under the fostering care and cultured guidance of His Royal Highness the Prince Consort, to whom art in this country owes very much, into the grand dimensions and scope of *the* Great Exhibition. It would be out of place here to dwell upon the unprecedented attractions and popularity of the display in Hyde Park, the influences of which fell upon a people prepared for their reception, by the activity in English art consequent upon the rebuilding of the Houses of Parliament, already referred to; by an important movement in the English Church, which contributed greatly to a revival of artistic feeling in connection with church architecture and ornament, and to the removal of many hideous disfigurements and abominations from our cathedrals and parish churches; by the greatly increased and more general acquaintance with the beautiful in art and nature, revealed to all classes of society by the photographic camera; and by other contributory agencies. Moreover, the Great Exhibition had for us the great charm of novelty, although foreign nations had become more or less familiar with displays of manufacturing industry. In France exhibitions of this kind had been held from the beginning of the century, having met with the warm encouragement of Bonaparte, who, when First Consul, visited the chief towns, in the company of several men of science,

for the purpose of convincing the manufacturers that, in their own interest, they should do all they could to support such undertakings. The exhibition held in the Champs Elysées in 1849 was the eleventh that had taken place on that spot, and similar displays had also been seen in Belgium and Bavaria. But if we were late in adopting this practical means of illustrating the position of manufacturing industry at home and abroad, it must be admitted that we were thorough; for the Exhibition in Hyde Park in 1851 was as far beyond anything that had been seen before, as its success was beyond the dreams of even its most enthusiastic promoters. In one important respect the exhibition was to us alike humiliating and useful. It convinced us of our modern inferiority in the industrial arts, and bestirred to redoubled effort organizations designed to remove this national reproach, dissipating our insular conceits, and teaching us to gather wisdom from our failures. The change which, since 1851, has come over all branches of applied art in this country is an astounding change; and to the spirit infused into our manufacturing industries by the comparisons of the Great Exhibition may be ascribed much of the improvement which it has been the aim of Schools of Art to foster and direct.

Mr. Richard Redgrave, R.A., in a voluminous report on the general state of design as applied to the various fabrics and manufactures in the Exhibition, thus referred to the lethargic indifference yet to be overcome in England :—

"The English public, and the English manufacturers as a body, are hardly yet awake on the question of design. Government has established schools of ornamental art in many of our large manufacturing towns for the purpose of spreading genuine taste, and educating our workmen; but they are as yet a forced product, and have hardly anywhere, after ten years of struggle, won the warm support of the local manufacturer. Even in this Great Exhibition the question of design was nearly overlooked, and the work of the designer left without a place. His name was not necessarily coupled with the fabrics or manufactures his skill had designed or decorated, and his reward therefore was left to the good feeling of his employer."

While the arrangements for the Great Exhibition were in progress, a request was made that in case the Schools of Design should contribute some of the works of the students to the forthcoming Great Exhibition, the Board of Trade would grant such pecuniary aid as might be thought adequate to the execution of designs otherwise too costly for the individual means of the student. Compliance with this request was not deemed expedient by the Board, but it is satisfactory to know that the Schools of Design were nevertheless represented, and creditably represented, in the first great "World's Fair," by some sixty designs selected from amongst those exhibited at Marlborough House. The sub-committee appointed to adjudicate upon the designs for manufactures reported that in those sent from Somerset House "they had observed a purity of taste, a propriety and chasteness of invention, and a well understood adaptation of style for the several objects, which do great credit to the directors and to their scholars." They therefore recommended that a prize medal should be awarded to the head School of Design, that "honourable mention" should be made of three of the pupils, and that six others should be mentioned with much approbation.

FORMATION OF THE DEPARTMENT OF PRACTICAL ART.

In the meantime it was found that the work of the Schools of Design in imparting advanced instruction was increasingly impeded by the want of national means for supplying elementary knowledge; and the Committee of Council on Education having assented to a proposition for the formation of classes for elementary drawing in National Schools, the establishment of such classes was initiated under encouraging circumstances, and the Committee caused useful treatises on the subject to be supplied to such schools either gratuitously or at reduced rates. The provincial Schools of Design were also thrown open gratuitously to such masters or teachers of schools under the control of the Committee of Council on Education as

might be desirous to qualify themselves to give instruction in elementary drawing, and the opportunity thus afforded was cordially welcomed by those for whose benefit it was provided, whilst the public could not fail to recognise the advantage of measures designed to bring instruction in art to the doors of the humblest members of the community. At the same time it was found that the proportion of students in the Schools of Design who were actually engaged in art-manufactures was progressively on the increase; indeed, it was in the manufactories of the towns in which schools were established that their highest productions were to be sought. It was a significant fact that during the preparation for the Great Exhibition the attendance of the more advanced students at their classes was greatly interrupted by the requirements of the time; stronger testimony could scarcely be borne to their merits and increased usefulness as designers and art-workmen. The reports on the provincial schools also showed that the students trained therein were increasingly employed in the manufactories, to such an extent in some places—Sheffield, for example—that the applications for the services of pupils could only be partially met. The manufacturers were, indeed, gradually becoming alive to two facts: first, to the necessity for improved designs, and second, to the ability of the schools to supply those who were qualified to produce and execute them. A new generation was springing up, less prejudiced and less opposed to change of method than that which had preceded it; in short, that effective mainspring of human action, self-interest, was gradually impelling the manufacturers to respect what they could not afford to ignore.

A year and a half having elapsed since the Select Committee of 1849 made their report, abundant time had been afforded for the digestion of their recommendations, when, in January 1852, a letter was addressed to the Treasury from the Board of Trade, stating that with a view to place the Schools of Design on a more satisfactory footing—for it was believed that there were defects in their

present management "calculated to lead to their disorganization, and to comparative failure in the objects for which they were established"—it was proposed to create a department of the Board of Trade, to be called "the Department of Practical Art," and to consist of two officers—one to give his whole time and attention to the business of the department and to be principally responsible to the Board for the proper conduct of every part of it, who should receive £1000 a year; and the other to be an artist of high professional character, whose advice and assistance would be indispensable, and who should receive £300 a year. These were to be entrusted with the management of the schools under the direction of the Board, and to be assisted by the Secretary of the School of Design, Mr. Deverell. It was further stated that it was intended to consider, without delay, the whole system on which the schools were conducted, and especially whether it might not be proper to concentrate the assistance rendered by the Government in the establishment of either one or a very few schools, to which only such pupils might be admitted as had already acquired the rudiments of artistic education, and had evinced their aptitude for its further advancement, leaving it to local exertion to provide this elementary instruction. The Treasury making no objection to the arrangements suggested, the Department of Practical Art was duly constituted, with Mr. Henry Cole, C.B., as General Superintendent, and Mr. Redgrave, R.A., as Superintendent of Art, and took up its quarters at Marlborough House, to which place the schools were temporarily removed from Somerset House, in August 1853, by permission of Her Majesty the Queen.

The main objects of the new Department were defined in a minute of the Board of Trade to be:—1, the promotion of elementary instruction in drawing and modelling; 2, special instruction in the knowledge and practice of ornamental art; 3, the practical application of such knowledge to the improvement of manufactures; and in March 1852 the two Superintendents addressed a joint letter to

the President of the Board of Trade, Mr. Henley, setting forth their views as to the mode in which these objects should be attained, and recommending certain principles for adoption in the management of the schools. These views were further enunciated in the first report of the Department, presented at the beginning of 1853, in which Mr. Cole more fully defined its objects to be—"1st, general instruction in art, as a branch of national education among all classes of the community, with the view of laying the foundation for correct judgment, both in the consumer and the producer of manufactures; 2nd, advanced instruction in art, with a view to its special cultivation; and lastly, the application of the principles of technical art to the improvement of manufactures, together with the establishment of museums, by which all classes might be induced to investigate those common principles of taste which may be traced in the works of excellence of all ages." Further, it was submitted that "the leading principle of the future management should be the endeavour to make the Department as far as practicable self-supporting in all its branches, and that its ultimate success as a permanent institution should rest chiefly upon the voluntary support which the public gave to it."

In order that the schools might be supplied with suitable examples for teaching the elements of form and colour the Art Superintendent formed a series of three collections, adapted to various stages of instruction; these were supplied at half their prime cost to the Department, either separately or all together, and this privilege was extended to all public schools throughout the kingdom. Mr. J. C. Robinson, one of the masters of the School of Design, who had distinguished himself by instructing some of the most advanced students, was appointed to the newly created office of Teachers' Training Master, and a class of school-masters and mistresses and pupil teachers, held on Saturdays at Marlborough House, numbered seventy persons of both sexes at its fourth meeting. To accommodate teachers at a distance tem-

porary arrangements were made to enable a trained master to visit groups of them, in order to demonstrate the mode of using the examples supplied. At the origin of the Schools of Design half the cost, or an equivalent to the Government grant, was guaranteed by the locality for three years; but very few localities kept the engagement. In 14 out of 17 provincial schools the local subscriptions did not equal the amount of the grant, and taking all of them together it was found that the Government contributed £6850 towards their maintenance, exclusive of the cost incurred in lectures, examples, and management; whilst the localities subscribed only £3447, or (with the fees) £5431. The total cost of art education for each student ranged from £2 2*s.* 7*d.* a year in Coventry to £10 11*s.* 2*d.* in Leeds; the average cost in the provincial schools was £4 6*s.* 5*d.*, and in the metropolitan schools £8 12*s.* The Superintendents of the Department, in their preliminary letter to the President of the Board of Trade, already referred to, pointed out that this was considerably more than a student paid in most private establishments for instruction in drawing.

It therefore became necessary to change the system, unless art was to be taught only as a charity; and the Board of Trade resolved, not indeed to discourage any local desires for art education, but to measure the expression of them by local acts. Therefore, if a locality desired to have a distinct school of elementary art, the first condition required under the new arrangements was that three existing local public schools must be willing that the whole of their scholars (both boys and girls) should receive at least one drawing lesson per week, and that each school should pay to the master attending not less than £5 a year, besides providing, at half the prime cost, models, examples, &c., according to their means. A committee of management must also engage to establish mid-day classes at one rate of fees, and evening classes at a lower rate, but not less than sixpence a week, and agree to pay the master half the proceeds of such fees. When these preliminaries

were arranged, the Board of Trade would appoint a master who had been specially trained, guaranteeing him an income of £70 for the first year, in case the fees did not reach that amount. The immediate result of these arrangements was seen in 140 applications for assistance, and at least 50 places appeared to be endeavouring to comply with the requisite conditions for having a distinct school of art.

In order to carry out the injunctions as to technical instruction (a prominent feature of this scheme) special classes were established at Marlborough House to enable advanced students to complete their studies in artistic anatomy and enter upon practical construction, wood engraving (for female students only), painting on porcelain, and decorative art in all kinds of woven fabrics and paper-staining, and in metals, furniture, and jewellery. Some of the earliest results of the work of the wood engraving class were seen in some very creditable illustrations to an official catalogue of ornamental casts in the possession of the Department, published in 1854. The class for painting on porcelain was retarded by the necessary preparations of the kilns, but when the students got to work their attention was directed to figure and landscape painting, in which the English porcelain painters were admittedly behind the French and Germans. In connection with the classes for applying the principles of ornamental art to the practice of metal working, inquiry was made amongst the manufacturers of gold and silver work, who were agreed as to the possibility of improving ornamental designs in the precious metals, but as to the probability that there would be a sufficient public to appreciate better art, and therefore willing to pay for it, various difficulties were pointed out. It appeared that it was too much the practice to consider the intrinsic value of the material as of the first importance, and that in a great commercial country like our own there were always opulent persons of uncultivated taste who thought more of show than of beauty. Some were of opinion that the taste of the manufacturers was already

considerably in advance of the public, and it was stated by one manufacturer that, to meet the public demand, there had been year by year a continually increasing supply of inferior articles, to the exclusion of better ones, and that "any experiment to obtain better art and art-workmanship in his business was not worth attempting." There was also the prejudice of the older workmen—not a novel experience—to be encountered, and even amongst the students themselves there was very little willingness to enter into a precise and special course of training. One student, although recommended from the Spitalfields school to hold a scholarship, resigned that prospect on being required to go through a course of designing for silk weaving, avowing that he desired to become a portrait painter; and others used the school, not for its special object of training in ornamental art, but as a means of studying Fine Art. Arrangements were, however, made, under which instruction in the several departments of applied art was given to students by competent persons, on payment of fees amounting to 50*s.* a quarter, or £8 a year; manufacturers, designers, &c., were at liberty to seek occasional advice as to their works or designs for 6s. a week, or 2s. each separate consultation, either personally or through the post; and manufacturers subscribing £5 could attend themselves or send their workmen at any time to obtain assistance in originating or executing ornamental designs. Nominations to scholarships, hitherto limited to metropolitan students, and appointments in the class of training masters, were extended to the provinces; lectures on the various styles of ornament were delivered, both at Marlborough House and at the provincial schools, by Mr. Wornum, the Professor of Ornamental Art; and the formation of an art library was commenced.

The estimate for the schools for the year 1851–2 amounted to nearly £18,000, as against £15,000 for 1850–1, and £10,000 for 1849–50.

THE MUSEUM OF MANUFACTURES AT MARLBOROUGH HOUSE.

It had long been thought desirable, both for the use of the schools and for the improvement of public taste, to form a Museum of Manufactures selected for their excellence in design or their skill in art workmanship, illustrative also of the history and progress of industrial art. Taking advantage of the French Exposition of National Industry at Paris in 1844, the Council at Somerset House, with the sanction of the Board of Trade, decided to expend £1400 on such examples of art-manufacture as might appear to the Director of the Schools calculated to benefit the students, as illustrations of applied design. The close of the Great Exhibition of 1851 affording a favourable opportunity for the further acquirement of modern examples, Parliament made a grant of £5000 for this purpose, and with this sum a selection was made by a Committee consisting of Mr. Pugin, Mr. Owen Jones, and the two Superintendents of the Department, consisting of woven fabrics, metal work, enamels, ceramics, wood carvings, and furniture. The articles so selected were removed to Marlborough House, where they were first exhibited to the public in May 1852, together with many loans and donations from Her Majesty the Queen, his Royal Highness the Prince Consort, the Royal Commissioners of the Great Exhibition, and many others, and thus was formed the nucleus of the incomparable collection now to be seen in the South Kensington Museum. At one time a prominent feature of the display at Marlborough House was a collection of carpets, chintzes, paper hangings, porcelain, &c., purposely selected as examples of "false principles" in decoration; and this section, though entertaining enough to the public, was productive of some amount of animadversion, for it was certainly not agreeable to manufacturers to find their productions—perhaps the most profitable ones—gibbeted in the eyes of the public with the announcement that there was "want of meaning and unity in the

pattern," that "the helter-skelter distribution of the lines" were like "productions under the influence of nightmare," and so forth. The names of the manufacturers were not mentioned, and in the later editions of the catalogue the more trenchant criticisms were softened down, but those who visited the exhibition will not readily forget the amusement caused by a display which was certainly somewhat invidious in its nature, and has never since been repeated.

FORMATION OF THE DEPARTMENT OF SCIENCE AND ART.

At the opening of Parliament in 1853 the Speech from the Throne indicated that a comprehensive scheme, having for its object "the advancement of the Fine Arts and of Practical Science," was about to be submitted, and in March of that year the scope of the newly formed Department was enlarged, the object in view being "to extend a system of encouragement to local institutions for Practical Science, similar to that already commenced in the Department of Practical Art; to combine the systems on an enlarged scale; and to furnish, through the instrumentality of one Department, in connection with the Executive Government, having the support and being subject to the control of Parliament, the means for mutual co-operation and correspondence to every district of the kingdom, where the local intelligence and energy of the inhabitants should create schools of Industrial Science and Art." Accordingly, the Government School of Mines and Science applied to the Arts, the Museum of Practical Geology, the Geological Survey, the Museum of Irish Industry, the Royal Dublin Society, and the Department of Practical Art, including the provincial Schools of Design, were brought within the operation of the new organization thenceforth known as the Department of Science and Art. It was provided that the action of the joint Department, in the general arrangements for affording assistance to schools, should be con-

ducted as a unity as much as possible, and not in separate divisions for science and art; and its proceedings may be broadly classed under four sections—1st, aid to institutions and schools entirely independent of the Department, bearing particularly on primary education; 2nd, aid to schools in connection with the Department, which may be viewed as promoting secondary education; 3rd, the central schools, influencing more particularly advanced or technical instruction; 4th, general administration.

The broad difference in principle between the old system and the new, so far as Schools of Art were concerned, was that, whereas formerly the Government had determined in what localities schools should be established, each locality was now called upon to decide for itself whether it would have a school or not, by satisfying the necessary conditions. By a minute of the 23rd of March, 1853, the Board of Trade, with the concurrence of the Treasury, left the whole general management, and the control of its cost, in the hands of the local committees. Government ceased to appoint the masters, or to pay their salaries. The Parliamentary grants were wholly confined to the promotion of instruction, and even on this point it seems to have been anticipated that Government control and Government grants might cease, for it was stated that "their lordships would view it as the highest mark of the progress and success of art education in any locality to find that the committee preferred independence of the Government grant altogether," an anticipation which has, however, failed of realisation.

Very soon after the formation of the new Department, it became evident that the previous efforts to give instruction to artizans in ornamental art had been unproductive of adequate results, from want of a wider diffusion of precise instruction in elementary drawing amongst all classes of the public. The Department therefore endeavoured to bring this about,—first, by extending the teaching of Schools of Art to as many as possible of the schools for general education in their vicinity, and more especially to those for the poorer classes; secondly, by devising means

for giving a systematic course of instruction in drawing to students in training colleges, pupil teachers, and schoolmasters and schoolmistresses generally, who might thus become qualified for certificates of competency; thirdly, by increasing the number of Schools of Art in the provinces, regulating the course of instruction therein, and requiring specified works to be sent up for examination and reward; and, fourthly, by the formation of a normal school for training qualified art-teachers, testing their qualifications, and granting certificates on the results.

In 1857 the organised annual inspection of art schools gave an additional stimulus to local effort, the Inspector awarding medals as local prizes, and selecting the best of the students' works to compete for the medallions and prizes offered in the national competition first established in the same year.

The Department of Science and Art remained under the control of the Board of Trade until February, 1857, when the Education Department was constituted, to include—(*a*) the Education Department of the Privy Council Office; (*b*) the Department of Science and Art; and these were placed under the Lord President of the Council, assisted by a Vice-President of the Committee of Council on Education. It was settled that the primary branch should continue to conduct its business at Whitehall, whilst the offices of the secondary branch should be located at South Kensington, to which place the central School of Art and the Museum had been removed from Marlborough House in July 1856. No doubt this important change was mainly due to the unceasing energy and bold determination of Mr. (afterwards Sir Henry) Cole. To use the words of the *Times*, written at a time when this moving spirit was at rest, "great national movements, like that which has produced the South Kensington Museum, and all that it represents in the social life of our time, are, no doubt, due to causes deeper and more universal than the energy of any individual. But the instinct is nevertheless sound in the main which identifies South

Kensington with Sir Henry Cole as its creator and chief representative."

In December 1857 a measure was adopted by the Department which had an important effect in extending the action of the Art Schools, namely, the augmentation of the allowance to art pupil-teachers from £10 to £20 a year, on condition that each should undertake to instruct in elementary drawing not fewer than 200 children educated in primary public schools for the poor. In almost every school pupils were found ready to qualify themselves; and during the year 1858 as many as 107 students of the various schools of art complied with the necessary conditions, whilst the number of poor children taught increased to 49,955, as compared with 28,974 in 1857. At the Central Training School, after two years' experience at South Kensington, it was found that the students were much more numerous than those who attended it at Marlborough House, and its efficiency both as a training school for art teachers, and as a centre for art-education, was very much strengthened. The students who entered the Training School were principally selected from those who, having distinguished themselves, obtained prize studentships or pupil teacherships in the provincial schools, and as they received weekly allowances towards their maintenance, and gratuitous training extending over a considerable period, admission to the school become an object of ambition.

In the summer of 1858 an exhibition of works of art-manufacture, designed or executed by students of Schools of Art, was held in the then temporary buildings of the South Kensington Museum. This, the first public display illustrative of the teaching and influences of the Schools, included examples of glass, ceramics, ornamental metalwork, plate and plated wares, jewellery, furniture and woodcarving, lace, linen damasks, silks, carpets and tapestry, sculpture, modelling, &c. Altogether there were 683 entries in the catalogue, the exhibitors including 209 students from 24 Schools of Art, besides male and female students employed by Messrs. Minton & Co., at Stoke-upon-Trent, and 94 manufacturers.

THE INTERNATIONAL EXHIBITION OF 1862.

The evidence afforded by the International Exhibition of 1862 as to the marked improvement observable in our art-manufactures since the first great display in Hyde Park in 1851, was abundant and decisive; and it would be unreasonable to deny that this improvement, and, indeed, the general advance of artistic taste in this country, may be attributed in great measure to the influences, direct and indirect, of the Schools of Art. We learn from a voluminous report prepared by Mr. George Wallis, that, with a view to ascertain the opinions of the manufacturers themselves as to the precise nature of the work done by the students, apart from all speculative opinions about methods of instruction and Schools of Art, a circular was addressed to exhibitors in the various classes in which decorative works were shown, asking for the names of students of the Schools of Art who had been employed by them as designers, draughtsmen, modellers, &c. Of 383 circulars issued 222 were returned, and it appeared from these that no fewer than 344 students, in the employ of 104 manufacturers, had been engaged on the works exhibited, in the following industries:—porcelain, 72; glass, 30; precious metals and jewellery, 24; iron and brass work, 62; furniture and decorations, 47; carpets and floorcloths, 21; silk fabrics, 20; lace, 18; woollen and mixed fabrics, 21; printed and dyed fabrics, 10; other industries, 19; total, 344. Further, it should be observed that these figures by no means indicated the total number of students employed by the manufacturers in question. Messrs. Minton & Co., for example, explained that although they had only given the names of twelve, fully two-thirds of the painters, gilders, and modellers in their employ were, or had been, students of the School of Art. Mr. Wallis explained that the difficulty of such an inquiry was considerably increased by the fact that in England the designer was not yet recognised as in France.

"British manufacturers," he said, "are not accustomed to declare the sources from which they obtain designs, and any appearance of interference with those employed by them is not liked; whilst any public recognition of the ability of their workmen, as such, is a novelty. Thus it frequently happens that whilst manufacturers will privately acknowledge themselves as being under considerable obligations to Schools of Art for the superiority of the apprentices and junior workmen in their employment, yet they hesitate to make any public statement to the same effect. . . . Whilst some manufacturers return a number of students as employed by them upon the works they exhibited, others in the same localities, obtaining apprentices and junior workmen from the same sources, make no return, or state that none of the students of the Schools of Art in their employment have assisted in the production of the articles exhibited by them."

Notwithstanding, however, the reticence thus complained of, alike unjust and impolitic, thirty-four manufacturers expressed very decided opinions in favour of the influence of the art instruction of the schools as regards its effects on ornamental industries and the general improvement of taste evidenced in the choice of patterns by consumers. Of twelve others who appended remarks to their returns, four expressed doubts as to the practical utility of the schools to their special industries, seven stated a decided conviction that the instruction had been of no use in their pursuits, and one, who had the courage of his convictions, stated plainly that in his opinion "those patterns were best that sold best."

Amongst other results of the Exhibition of 1862, the Report of the Science and Art Department for that year notices the testimony afforded by several foreign Governments as to their sense of the great influence of the Department on the industrial progress of the country. Applications for detailed information as to its working had been received from France, Austria, Belgium, Wurtemberg, Switzerland, Denmark, and Italy, and the French jurors at the Exhibition were by no means sparing in their commendations. M. Merimée stated that English industry, "which from the artistic point of view seemed greatly in arrear at the Exhibition of 1851," had during the last ten years "made amazing progress," and fully admitted the

testimony of the English members of the jury, who, when questioned as to the causes to which they ascribed the progress so obvious in the products of their manufactures, "assigned a chief place to the new resources opened to industry by the schools of South Kensington." M. Natalis Rondot, a juror thoroughly acquainted with the Lyons school, and the system of instruction in vogue throughout France, said that in almost every direction the influence of a larger number of teachers of drawing and of working draughtsmen was making itself felt in England; that the manufacturers of Nottingham, Manchester, Sheffield, Worcester, and Staffordshire, "recognised the fact that their best designers came from the Schools of Art, and that, thanks to them, the general character of designs and of forms had undergone the most happy modification." Other testimony to the same effect might be cited, but these quotations must suffice to show the feeling inspired by the work of the schools in the minds of foreigners, whose views were enforced in a report made by M. Rouher to Napoleon III. in June 1863, in which it was stated that "the results of the late International Exhibition of 1862 may have excited apprehensions that, if France have not remained stationary in the production of works of art and taste, in which the first rank has hitherto belonged to her, her rivals have approached her more and more nearly, and that, unless she makes new and rapid progress, she may at an early date be left behind."

THIRD SELECT COMMITTEE OF THE HOUSE OF COMMONS.

In the autumn of 1862 and the spring of 1863—at which time the number of students and others learning drawing had increased from 3296 in 1851 to 87,389 in 1862, of whom 71,423 were children attending elementary day schools and receiving one or two drawing lessons a week from the master of the neighbouring School of Art—some changes were resolved upon which excited a considerable

amount of discontent amongst the masters. Four minutes were adopted by the Committee of Council on Education, the first of which provided that certain payments should be made on results of instruction in drawing in schools for the poor, to be divided in varying proportions between the master of the School of Art and the managers of the primary school in which instruction had been given, according as the master of the latter did or did not hold a certificate of competency to teach drawing; and that certain payments should also be made in respect of pupil-teachers who might pass a certain examination. The second minute provided that, from the 1st of October, 1863, payments should cease to be made upon certificates taken by masters of Schools of Art; that "a system of payments on results should wholly regulate the payments to Schools of Art, and that such payments should be made only on behalf of artizans, children of the labouring poor, scholarships, persons in training as art teachers or employed as designers for manufacturers." The third minute abolished prize studentships and art pupil teacherships, and established in lieu thereof local scholarships and national scholarships—the number of the former to be regulated at each school by "the number of children taught drawing in schools for the poor in connection with the local art school," the number of the latter to be fifteen in all, and to be annually offered in competition to the various local schools, to enable advanced students already engaged as, or about to become, designers or art-workmen, to prosecute their studies at the central school at South Kensington. The fourth minute prescribed the complicated conditions on which the payments contemplated by the second minute should be made. The twenty-three stages of the course of instruction were subdivided into sixty-one sections, in fourteen of which no local medals could be gained, and there were only thirty-one in which national medallions could be gained. Payments were only to be made in respect of medals and medallions gained by artizans, and these were necessarily limited by the fact that all classes of students were equally entitled to compete

for them, so that although a number of artizans might reach the medal standard they might be beaten by students who were not artizans, in which case the payment would be lost to the school.

It was chiefly owing to these changes, and to a sense of injustice awakened by them in the minds of the masters of the Schools of Art, that in 1864 a third Select Committee of the House of Commons was appointed, with Sir Stafford Northcote as its Chairman, to inquire into their constitution, working, and success, and into the system on which the Parliamentary grants for the promotion of national education in art were administered. To deal first with the case of the certificated masters, it appears that they complained, and not unreasonably, that a breach of faith had been committed by the substitution of a system of payment on results for the system (established in 1854) of fixed payments on their certificates. They contended that expectations were held out to them that, if they would study the course of teaching prescribed by the Department, and would qualify themselves to teach that course in the schools assisted by the Government, they should receive for such teaching a certain annual payment proportioned to their proficiency; and that their certificates contained a guarantee of a fixed annual payment of £10 on each, up to a maximum of £50, so long as they were so engaged. On the other hand, it was urged that the notice on the certificates did not amount to a guarantee; that the masters (though appointed by the Government) were the servants, not of the Government, but of the local committees; and that the payments made on the certificates were to be regarded as payments to the schools rather than to the masters. The masters supported their plea by arguments drawn from certain minutes and announcements, and from verbal assurances, and the report of the Select Committee, which dealt at great length with these issues, while stating that they did not consider that the change complained of was necessarily wrong, or involved any breach of contract on the part of the Government, admitted that there was much force in the

argument that the certificate payment was intended to remunerate the masters for work which they were called upon to do in the instruction of artizans at a low fixed rate of fees, and of elementary pupils in primary schools, from whom they probably received no payment at all. The Committee felt, however, that a master ought to be properly compensated for such labour by those who required it of him ; and, on a review of the broader question involving this side issue, they expressed an opinion that the system of payment on results was not adapted to the Schools of Art, mainly on the ground that it had a tendency to destroy the elasticity of art teaching, and thus to cramp the genius of designers, to render the schools unpopular, and to diminish the chance of local support. At the same time, the Committee agreed with the Department as to the inconveniences attending payment on certificates, and suggested recourse to a system of capitation payment, regulated by the number of artizans receiving instruction. Though the annual monetary value of their certificates was not restored, the masters got rid at the same time of a variety of trammels which had impeded the efficient management of the schools ; and efforts were subsequently made, by successive adjustments of the system of payments, to compensate them for that source of remuneration of which they were, as they believed, unfairly deprived. There is no reason to suppose that the masters generally were unwilling that their remuneration should be gauged by the results of their work, but they were not unnaturally opposed to a change which had the effect of reducing their incomes, and the most efficient were discouraged by a system which made the best and highest kind of teaching unremunerative. It is manifestly desirable that an earnest and capable teacher should be left as unrestrained as possible, and should not feel it to be his main object to lead his pupils to just those results which bring him the most remuneration, instead of cultivating their ability to the highest point within its compass ; whilst, on the other hand, it is necessary to protect the State against that laxity

which is too apt to be the result of direct payments made independent of results. A combination of the two systems is doubtless the most expedient, in the interests both of the nation and of those by whom it is served.

The evidence taken by the Select Committee as to the influence exercised by the Schools of Art, showed that there had been an extraordinary and undeniable improvement in general taste since 1851, that this improvement and the education of designers had advanced together, and that no small share of the credit for this advance was certainly due to the operation of the Schools of Art. There had, consequently, been a great and remarkable improvement in our manufactures, encouraged and in a measure necessitated by the more cultivated taste of the consumer. The necessity to produce what will sell may be regarded as a constant factor in the problem with which manufacturers and designers have to deal, and has naturally too exclusive an influence on what are known as self-made men—men who, though of much natural shrewdness and ability, are sometimes deficient in culture. As an evidence of the public taste, it was stated that a carpet design exhibited at the Exhibition of 1851, and condemned by all critics, was the most successful pattern ever brought out by the exhibiting firm; and a calico printer informed the Committee of 1864, that having produced what he regarded as a pattern of some taste, he found it necessary, in order to supply the requirements of a foreign customer, to introduce a watch-face into the centre of it! Of course, he said, he did not hesitate for a moment, his object being to introduce as much taste as he could sell, and, when necessary, to bring himself down to the level of his customers. One of the witnesses examined by the Committee, Mr. E. Potter, M.P.—the only calico printer who took part in the earliest movement (in 1838) for the establishment of a School of Design at Manchester, and therefore a witness who could not be regarded as unfavourable to such institutions—expressed an opinion that the schools had not had much to do with the progress of taste

in English manufactures, stating also that in Manchester they were more than ever dependent on the French for designs, for which, to his knowledge, from £25,000 to £30,000 a year was paid by twelve firms, the total outlay of the trade in this direction being probably £50,000 a year. But he thought it degrading to an artist to bring himself down to the designs required for calico printing, and admitted that the manufacturers did not support or appreciate the local School of Art, the general feeling being that it had been of very slight value: although the calico trade amounted to thirteen or fourteen millions sterling per year, the subscriptions of the manufacturers did not amount to more than £200 at the outside, and even this was very reluctantly given. On the other hand, Mr. E. Akroyd, of Halifax, stated that all their designs used to be imported from France, but now the foreign designers were very much superseded by those trained in the School of Art. Glasgow and other places afforded similar testimony to the advantages and influence of the schools on local industries; and it is not improbable that if only a tithe of the large amount spent by Manchester on foreign designs had been judiciously applied to the encouragement of the native talent which it is their mission to develop, a very different result might have been seen there, under favourable conditions as to school management and teaching, on which success so greatly depends. At Glasgow the manufacturers generally appreciated the importance of the schools, but complained that they were ruled by the Department without reference to local requirements—another reason for the necessity, already insisted on, of leaving them as far as possible to local control—and consequently the subscriptions had fluctuated greatly, being in one year upwards of £1000, in another under £50. Varying testimony was given on this point, some thinking that, as the schools were designed to benefit manufacturers, manufacturers should maintain them; whilst men of wider views recognised the national value of the training imparted, apart from local or special interests. And though it was in many

places difficult to secure the pecuniary support of the manufacturers, in others they subscribed with great liberality, and showed their intelligence by insisting on the attendance of their designers and apprentices at the neighbouring Schools of Art. Taking the evidence as a whole, the influence of the schools in the improvement of manufactures, the development of public taste, and the substitution to a material extent of English for foreign designers, was conclusively established.

A statistical comparison between the years 1851 and 1863 showed that the number of provincial Schools of Art had increased from 17 to 80, and of the metropolitan schools from 2 to 12, exclusive of the National Art Training School at South Kensington; the students in the provincial schools had increased from 2842 to 13,856, and in the metropolitan schools from 454 to 1929, exclusive of 65 students in training, and 540 paying students at the National Art Training School; the Government grants (exclusive of examples, library, &c.) had increased from £6850 to £11,095 for the provincial schools and from £3474 to £5496 for the metropolitan schools, the latter amount including £4450 for the National Art Training School; and the cost of examples of art, books, school furniture, fittings, inspection, lectures, &c., had increased from £4730 to £19,278, of which £9789 was for objects for the Art Museum, and £1000 for the Library.

The amount of fees paid by the provincial students had increased from £1994 to £9560, and of the metropolitan students from £442 to £1312, with £1508 additional from the paying students at the National Art Training School. Mr. Cole argued that the system was rapidly becoming a self-supporting one, for although the Government grants applicable to Schools of Art had increased from £15,055 in 1851 to £46,636 in 1863, the average cost per school was now only £510, instead of £880, whilst the average cost per student was reduced from £4 10*s.* to 10*s.* 8*d.* if he included the children of the National Schools in the calculation, or £2 11*s.* 10*d.* without them. It should be

observed, however, that the cost per school is not a sound basis for such an argument, inasmuch as the earliest schools were uniformly established in important manufacturing centres, whilst the later ones included within their scope many smaller towns, and the cost per head is necessarily affected by establishment and other charges, which do not increase in the same proportion as the number of students. In the course of his evidence, Mr. Cole made renewed suggestions for the formation of local museums, to be encouraged by the circulation of works of art, not only from the national collection at South Kensington, but also from the National Gallery and the British Museum; and in this, as in other matters, he anticipated the action of later times.*

The Committee embodied their conclusions in a series of resolutions, in which they recommended that the Central Training School for teachers should be maintained, that sufficiently qualified scholars from the local schools should be admitted thereto at the expense of the State—the study of decorative art useful for manufactures being the primary object—and that other scholars should also be admitted on payment of remunerative fees; that the collection of works of art at South Kensington should be made more generally useful throughout the country, especially in connection with local museums; that a national contribution of works from the local Schools of Art should continue to be held annually at South Kensington, and a limited number of prizes awarded; that local Schools of Art be left to establish themselves wherever they could take root, and to extend their operations to all classes of society, such fees being charged as their managers might think desirable; that the conditions of State aid to local schools be (*a*) that night classes for artizans be open at least three times a week, at fees within the reach of artizans, (*b*) that the teachers be certificated, and receive the whole of the fees of the artizan

* The importance of public Galleries or Museums of Art was dwelt upon in the report of the Select Committee of 1835. (See *ante*, pp. 762–763.)

classes, and (*c*) that the localities provide suitable premises and pay all the charges for rent, taxes, and repairs; that no further grants be made in aid of building, renting, or repairing Schools of Art, or for the purchase of examples, models, casts, or apparatus; that it be a condition of Government aid that a public examination of every aided school be held annually, the results reported to the Department, and the works of the competing students (certified as genuine) be sent up to the Department; that certificated art teachers should receive a capitation payment for every artizan student receiving forty lessons in the year; that fewer prizes and no medals be given by the Department in local examinations; that State aid might be wholly or partially withheld on the report of an Inspector as to unsuitability of premises, bad models or apparatus, or deficient teaching; and that the votes for the Schools of Art and the South Kensington Museum should in future be kept distinct.

The Education Department, while agreeing generally with the opinion of the Select Committee, that Schools of Art should rely chiefly on their own resources and local exertions, being relieved from Government control, and free to work according to the wishes and wants of each locality, did not express entire concurrence in the proposed abolition of most of the indirect sources of aid, and the conversion of all payments into one capitation grant to each School of Art. They also regretted the proposal to put an end to building grants, and questioned the policy of withdrawing aid in the purchase of examples. Generally speaking, however, the recommendations of the Committee were acted upon.

CHANGES IN THE PERIOD 1864–84.

In April 1864 a Royal Charter of Incorporation was granted, constituting the Lord President of the Council and the Vice-President of the Committee of Council on Education, for the time being, as a body corporate under the name of the Department of Science and Art, and in

the same year important arrangements were made with foreign governments for the interchange of reproductions of works of art. In 1864, also, some of the students and national scholars in the Training School were formed into an etching class, which has since been useful in providing illustrations of ornament from objects in the Museum for distribution amongst the local schools, and it is still an object of ambition to enter it. In June 1865, in deference to the views expressed by a very influential deputation representing the Schools of Art throughout the kingdom, the Department resumed the building grants and grants for examples, and a new schedule was adopted relative to the payments made on behalf of artizans and poor children, in the hope that art teachers would be able to earn payments equivalent to the value formerly attached to their certificates, to which the authorities declined to revert. In the same year provision was made for the affiliation to the Department of night classes for instruction in drawing, and nine such classes, the first of their kind, were examined in the following March. In 1866 increased payments were made on account of satisfactory elementary works executed by artizans, and allowances were granted to students in training on receiving appointments as masters of Schools of Art. In 1867 the Education Department authorised a further increase of the payments in aid of art instruction, and, finding that the withdrawal of the certificate payments to the masters—amounting in 1863-4 to £2,400—had tended to induce them to identify their interest "less with the sound instruction encouraged by the Department, than with the capricious wishes of the middle classes, who at present rather resist such sound instruction," a series of bonuses, thirty-nine in all, and varying from £10 to £50 each, were offered to the masters of those schools whose works should be most satisfactory in proportion to the number of their students. In the same year the Plasterers' Company offered £25 in prizes for designing and modelling architectural details, and this encouragement, extended to the metropolitan and provincial schools alike, was

repeated in several subsequent years. In 1868 prizes were offered by the Education Department for fan-painting by female students, and during the year a class was formed for painting on porcelain, with a view to its application to architectural decoration, the tiles in the grill-room at the South Kensington Museum, painted from designs by Mr. Poynter, being the first-fruits of the instruction so imparted. A table appended to his report by Mr. Burchett, then Head Master of the National Art Training School, showed that in the twelve years that had elapsed since the school was removed to South Kensington, the number of its students had increased from 509 to 1133, and the amount of fees from £494 to £2162, whilst the cost to the Department had decreased from £2115 to £1295. In 1871 it became necessary, in order to enable the school to fulfil with efficiency its primary object of training masters for Art Schools, to check the admission of students seeking instruction in mere elementary drawing, by imposing an examination test and making other alterations in the regulations. It was also found at this time that in the provincial schools the amount of work in the advanced section did not greatly increase, while the elementary work did so largely; and as it was considered that the advanced results were inadequately rewarded, a material increase in the maximum grant for the advanced section was authorised. In this year the pottery class was transplanted to a studio established on a commercial basis by Messrs. Minton, on the ground of the Commissioners for the Exhibition of 1851, at Kensington Gore, where a kiln and other necessary buildings were erected, but a year or two later it was discontinued. In 1872 the bonuses to the masters of Schools of Art, dependent on the results of their instruction, were materially increased in number and value, for whereas the old scale provided prizes for the schools in the proportion of one to three, at an aggregate cost of £720, the new scale gave half as many prizes as there were schools, at a cost of £1,050. Similar encouragement (amounting to £320) was also extended to night classes for elementary drawing. The

example set by the Plasterers' Company in offering prizes to the students was followed in 1873, and in subsequent years, by the Goldsmiths' Company, the Painters' Company, the Council of the Art Union of London, and others; the prizes of the Goldsmiths' Company were offered to open competition, but of the total amount (£225) £150 was carried off by students of the National Art Training School. In 1876 it was decided to extend the aid granted to night classes to art classes held in any school or other institution complying with the rules of the Department; and in the same year the bonuses offered to the masters of the art night classes (one of £20, ten of £10, and forty of £5), and to the masters of Schools of Art (one of £50, three of £40, six of £30, twenty of £20, and thirty of £10), were withdrawn. For the former the Department substituted 20*s.* on account of every industrial student who should submit satisfactory works in the advanced stages of instruction; in place of the bonuses to the masters of the Schools of Art, the sum of 30*s.*, paid on account of every student who should submit satisfactory work in drawing, painting, modelling, or designing for architecture, manufactures, or decoration, was increased to 40*s.*, and additional payments (£2 for every exercise marked "satisfactory," and £3 for every exercise marked "excellent") were offered on the results of examinations in the various subjects (ten in number) of the third grade, limited to students who had previously passed in the four subjects of the second grade in local Schools of Art. This system is substantially in force still, and the change thus effected may be regarded as the last of the series of changes consequent upon the withdrawal of the certificate money from the teachers of elementary schools in 1862, and from the masters of Schools of Art in 1863. The bonuses had never been regarded with much favour by the masters, for, as they were awarded on results proportioned to the number of students, many of the largest and best schools were, so to speak, unfairly handicapped, and occupied a lower position in order of merit than that to which

they were fairly entitled by their success, a circumstance discouraging to masters and students alike.

In 1876 Mr. Sparkes—who had in February of that year been appointed Head Master of the National Art Training School—was requested to visit the Art Schools of Belgium and Düsseldorf, and made a report in which he expressed an opinion that the Belgian system was in advance of our own in the amplitude of their school buildings, which enabled every cast to be well lighted, well seen, and drawn from in comfort; in the time limit placed on every work, whether for practice or for competition; in the teaching of students to imitate what they copied, on the assumption that they were all to become painters; and in the plan of carrying on theory by lecture and practice in the schools simultaneously, with strict examinations in both. The time limit has since been found to be the most effective mode of strengthening the work and maturing the experience of students, who without it would be too apt to spend their time less usefully in attaining that elaborate refinement of finish deemed essential to secure admission to the schools of the Royal Academy, preparation for which can only be regarded as an incidental result of the training carried on in the Schools of Art, whose main object, as has been stated over and over again, is "the promotion of instruction in elementary drawing as a part of national education, and in Fine Art as applied to industry." *

The 25th Report of the Department announced the gratifying fact that during the five years 1873–77 the number

* Mr. Poynter, R.A., in an address delivered at the opening of the Slade School of Fine Art in University College, London, Oct. 2, 1871, speaking of the drawings sent up at that time from the Schools of Art to the central competition at South Kensington, said: "Are any of them executed under six weeks of painful stippling with chalk and bread? How much knowledge of the figure is it to be supposed the student has acquired during the process? Some of these prize drawings have come under my notice, of which the elaborately stippled background alone must have occupied more than a fortnight in the execution." It is to be hoped that Mr. Poynter's views on this point may in due course leaven the distinguished body of which he is a member, and have their full effect on the Academy schools themselves.

of institutions in which instruction was given in drawing or in higher art, with the aid of the Department, and subject to its inspection, had nearly doubled. The number of persons taught, and the exercises and works examined, had more than doubled during the same period; and the total amount of the aid given by the Department in payments on the results of this instruction had risen nearly 60 per cent. (from £31,918 in 1873 to £49,960 in 1877), an increase which compared favourably with the increase of the means of instruction and the number of persons taught. In 1878 it was thought desirable to raise the qualifications of the teachers of "art classes," of which there were now no fewer than 871 in operation, and the local examination of students of Schools of Art was extended to more advanced subjects of instruction. The result of these successive changes is that the extension of art instruction is now promoted by regulations under which aid is given—1st, to Elementary Day Schools where drawing is taught concurrently with reading and writing, and is specially directed to the improvement and refinement of the perceptive powers of the children; 2nd, to Diocesan and other Training Colleges, in which teachers of elementary schools may obtain certificates as teachers of drawing; 3rd, to Art Classes for children above twelve years of age and artizans, in which classes the primary instruction of the children is carried further than in the elementary schools, and they are associated with adult students in the study of form, light and shade, and linear drawing; 4th, to Schools of Art which are entirely devoted to art instruction, and where the student, after having obtained sound elementary knowledge, pursues the technical study of art in the direction required by his occupation; and, 5th, to selected students of local Schools of Art, who obtain scholarships at the National Art Training School at South Kensington, maintained for training art teachers, designers, and art-workmen, who are aided by scholarships gained in Schools of Art, under the system first established in 1863. The instruction given at the National Art Training School includes the following

subjects:—Freehand, architectural, and mechanical drawing; practical geometry and perspective; painting in oil, tempera, and water colours; modelling, moulding, and casting. The classes for drawing, painting, and modelling include architectural and other ornament, flowers, objects of still life, &c., the figure from the antique and the life, and the study of anatomy as applicable to art. The school is devoted primarily to the advanced instruction of those who have merited scholarships by their success in the local schools; but schoolmasters, schoolmistresses, and pupil teachers of public elementary schools, and artizans, may attend evening classes at low rates of payment, and the courses of instruction are also open to the general public on payment of higher fees, but no students are admitted until they have passed an examination in freehand drawing of the second grade. For particulars as to matters of detail inquirers are referred to the Art Directory, which may be obtained at the South Kensington Museum, and to the prospectuses issued by the Department and by the local schools, a chronological list of which, together with statistical information showing their progressive advance in numbers and usefulness, will be found in Appendices C, D, and E.

The Secretary and permanent head of the Science and Art Department is Colonel Donnelly, R.E., who has been connected with it since 1858. The principal officer of the art division has from time to time been known under various designations, which it is unnecessary to recapitulate. In September 1875, on the retirement of Mr. Richard Redgrave, R.A., Mr. E. J. Poynter, A.R.A., was selected to fill the post of Director for Art; and, in addition to the duties formerly discharged by Mr. Redgrave, was also appointed Principal of the Art Training School.* In 1881, on the

* A Treasury Minute, referring to these changes, speaks of Mr. Redgrave as having been "virtually obliged to abandon the exercise of a lucrative profession, in which he held a distinguished place," and states that to recount the services he had rendered in various offices "would be to write the history of the Art Department from the date of its first establishment."

resignation of Mr. Poynter, the two posts of Director for Art and Principal of the National Art Training School were separated, Mr. Thomas Armstrong was appointed Director, and the office of Principal was conferred on Mr. John Sparkes, who had assumed the Head-Mastership of the school after the death of Mr. R. Burchett in 1875. The office of Visitor of the Art Training School was at the same time created, and accepted by Mr. Poynter.

CHAPTER III.

WORK AND INFLUENCES OF SCHOOLS OF ART.

THE reader has seen in the foregoing pages how the Schools of Art have, in the course of half a century, passed through many changes of government, scope, and administration, until in place of a mere handful of students at Somerset House we have a vast organization consisting of 177 distinct Schools of Art, in which, according to the latest returns, nearly 34,000 students are under systematic instruction, in addition to as many more in Training Colleges for elementary school teachers, art classes, and schools examined but not aided by the Department, and more than twenty times that number who receive some modicum of instruction in drawing in elementary day schools; altogether, between 800,000 and 900,000 persons are brought under the direct influence of the Department. The annual cost to the Exchequer has risen to £26,376, but this expenditure is far more profitable to the nation than the smaller amounts formerly granted; for as the payments on results have advanced, the results themselves have advanced in a still greater ratio, and it is curious to observe that the success of the schools and their influence on our national manufactures have in a great measure sprung from the very causes that seemed most likely to retard their progress and check their operation. We have seen that Parliament was most tardy in its encouragement of art in any shape, and the establishment of Schools of Design, regarded by the British taxpayer as simply an experimental measure, and encountering, moreover, except in rare instances, the indifference, if not the hostility and unreason-

ing jealousy of those who but for their influence would now be lamentably behind other nations in the industrial arts, would not perhaps have been possible but for the idea that they might in course of time become self-supporting. Can it be that Sir Henry Cole, shrewdly estimating the various hindrances to the object he had in view, and desiring to reduce them to a minimum, felt that a fair start could only be effected on this basis, and made the most of the possibility at which he aimed in order to disarm the antagonism ot utilitarians who will not believe in anything until it can be seen, weighed, or counted? That the schools will become entirely self-supporting is scarcely likely, nor is it perhaps altogether to be desired, for such a result would free them entirely from Government control, and this, although apt at times to be injudiciously directed, is nevertheless useful in securing to earnest teachers recognition of work which would otherwise be entirely dependent for appreciation on local capacity, and possibly on local caprice. It is more to the purpose to urge—and it may be fairly urged, as a most satisfactory aspect of this question—that although the Government grant gradually increases, the value of the schools to the country, measuring it simply in its pecuniary sense, is infinitely beyond the amount contributed by the country towards their support. But in order to eke out the allowances voted by Parliament it has been found necessary to admit to the classes, not only those for whom they are specially designed, but also amateur students who could afford to pay the higher fees demanded for their participation in the instruction afforded. And herein lies one important difference between our system and the Continental system. On the Continent art schools are cherished and maintained by the State at any reasonable cost necessary for the full fruition of their usefulness, but the general public, whose money is not required for their support except in the indirect form of taxation, do not as a rule partake of the instruction provided. In England, owing to the necessities of the case, the public are so admitted in large numbers—for about one-fourth of the whole number under

instruction in Schools of Art are amateurs,* notwithstanding the various measures adopted from time to time to check their admission; and thus—though not in the slightest degree through any foresight on our part, but simply as an accident arising from a somewhat parsimonious policy—we have what is of the utmost value, an educated public. On the Continent designers and art-workmen are trained, as has been said, almost regardless of cost; and the public have to derive their artistic inspirations from what they see around them, with very little help from well-directed artistic training. In England, on the contrary, producers and purchasers have been trained together; amateur students—who of course bear a far larger proportion to the artizans in non-manufacturing than in manufacturing districts—carry with them to their homes from Schools of Art, not only that innate admiration of the beautiful which led them there, but with it a cultivated taste that brings all around within the circle of its ever-widening influences. Thus, with a race of designers superior to any that have preceded them, has grown up also a race of cultivated purchasers, but for whom, it is needless to say, national excellence of production, however artistic, would be unprofitable, and therefore impracticable. It would be of no use to give the country designers, if the public were unprepared to appreciate their work; even as it is, the designers are always in advance of the market, for those works which are in the best taste are not those which find the readiest sale. The popular taste is never the highest taste, and in catering for the fancy of the hour, lady amateurs who dispose of their labour at a low price should bear in mind their poorer sisters in art, whom they may drive out of the market, which, like other English markets, is in its lower departments greatly overstocked with applicants for employment. The demand for the higher excellences is, indeed, a matter which no amount of education can quite determine, for it is greatly dependent

* Most of the amateur students are ladies, and the great majority of them attend the schools for the purpose of turning their talents to profitable account, and not for mere amusement.

also on the ever-varying conditions of the country—on its prosperity and wealth, on political excitement and financial crises, on periods of depression, agricultural or commercial—for the best things are usually the dearest, and high art is a luxury unattainable when necessities become the subject of concern. Nevertheless, artistic excellence, even if neglected for awhile, cannot fail in its educating influence, paving the way for the demands of a more hopeful season.

But amid all the changes of the last fifty years, the work of the schools, ill directed or well directed, has gone on, fluctuating in the force of its influences, but always contributing largely to such advance as has been manifest in our art industries and in the popular taste. Evidence of this has been found in the growth of the schools themselves, in the employment of the students, in the increasing excellence of our designs, and in the gradual supercession of foreign by native skill. It is not too much to say that previous to the establishment of the School of Design at Somerset House in 1837, our manufacturing districts were utterly destitute of instruction in art and mainly dependent on foreign aid for designs worthy of production. To those, therefore, who would disparage the work of the schools, the fact that French monopoly of designing is at an end, so far as English manufacture is concerned, should be in itself a sufficient answer, irrespective of other considerations. Instead of our going abroad for designs, foreigners, becoming familiarised with our advance in the industrial arts, are now continually coming to examine our system of teaching, to study our methods, and to avail themselves of the examples placed before our pupils at South Kensington and elsewhere, to the value of which they are indeed as much alive as our home manufacturers.* As an illustration of the altered relations between England and France, it may be stated that about five years ago one of the first manufacturers in Paris sent over to England for a collection of English

* Some time back 2000 copies of a small publication containing lithographs of some of the objects in the Museum were ordered by a publisher for the use of the students in France and Germany.

designs in paper-hangings, in order that his designers might avail themselves of them. Indeed, at a much earlier period than this (in 1868 and 1869) a number of designs for silk damasks, cretonnes, and paper-hangings, were purchased by a French firm from students in the Training School at South Kensington, and were successfully produced in France. For evidence of our general advance in artistic culture, it is but necessary to consult those who are old enough to remember the changes of the last thirty years, and to hear what they have to say of the improved appearance of our shops and shop-fittings, our "warehouses" and wares, our furniture and table appointments, our wall-papers and carpets, our books and book-bindings, our illustrated periodicals, our children's toys and picture-books, into which Richard Caldecott, Walter Crane, and Kate Greenaway have introduced artistic treatment of quite an original character, delighting young and old alike. There is scarcely a household in the country that is not the better for the change, not a manufacture in which design has a place that has not felt its influences; and it would be altogether idle to deny that this advance, to be seen on every side, is greatly attributable to the Schools of Art.*

With respect to the influence of the Department on elementary drawing, statistics show that between 700,000 and 800,000 children are receiving such instruction in elementary day schools, in addition to those who are commencing their artistic education in Schools of Art; but this elementary teaching is not what it ought to be and might be, for it proceeds too much on the lines of free hand and model drawing and practical geometry, whilst

* Mention might also be made of the marked change in the condition of our old parish churches, formerly to be seen with their beautiful stonework coated with innumerable layers of paint and whitewash, with their open-timbered roofs hidden by flat ceilings, with the warm tone of the outer rubble demolished by a vile coating of plaster, (in some cases applied also to the stonework, which had to be chipped with the plasterer's hammer to make it adhere), and with their carved oaken furniture serving only as a mutilated support for the commonest structures of deal.

insufficient attention is given to mechanical drawing, and black-board teaching is greatly neglected. About thirty years ago more attention was given to this matter, at a time when each master in training had three or four national schools to attend to, the work being done under the supervision of the head master, who was very efficiently assisted in the work of inspection by Mr. Swinstead, one of the masters; and it was sought to interest both masters in art schools and those in elementary schools by a money grant, which they shared between them. Gradually the elementary master became entitled to his drawing certificate on passing an examination in four second grade subjects, with a fifth for black-board drawing or writing; and as his teaching power was subjected to no test, classes soon fell into a feeble condition. The system of examination at South Kensington doubtless failed to prevent this, and hence our backward condition as compared with foreign countries; but it may be doubted if a remedy for the present weaknesses in our elementary teaching is to be found in a suggestion made in the Report of the Technical Commission, namely, "that the instruction in drawing in elementary schools should be as carefully supervised on the spot by the Whitehall Inspectors as is that in other branches of primary education," unless indeed a distinct staff of Inspectors should be appointed for the purpose, possessing trained artistic ability. The more advanced elementary drawing of the second grade is usually very well done, though even here, as in the earlier stage, a system of coaching up from copies for the examination on which payment is made is not unlikely to prevail when the master's income is in any degree dependent on its results. The exclusion of large work done from black-board examples in a given time is much to be regretted, as the plan of working down to examination copy standard for a monetary result is inadequate to develop the power most useful to children about to engage in various handicrafts.

If we regard the Schools of Art under their original

designation as essentially Schools of Design, it cannot be doubted that they have had a most useful past; and, in anticipation of a still more useful future, attention may be drawn to the large proportion of schools to be found in towns where design is of the first importance to the success of the local manufactures. (See Appendix C.) Moreover, information as to the employment of ex-students as designers has been sought at the various schools, and although in several cases they were stated to be so numerous that a list of names could not be attempted, and in almost all the record was dependent on the imperfect recollection of the master, extending sometimes over a very limited period, lists of names have been received showing that many hundreds of men and women trained in the schools are at this moment engaged in the work of designing, not only in England, but also in France, Russia, Spain, America, Australia, New Zealand, India, the Cape of Good Hope, &c., and at home they have in many places superseded foreign designers.* At Sheffield, for example, a dozen French designers and artist chasers were in 1852 the chief authorities on design and taste, and their work was mostly of a depraved Louis Quatorze character. The manufacturers being indifferent to art, the designers were absolute in their control, and the public, beguiled by richness of treatment, made no objection to the style then in vogue. Ten years later these foreign modellers and designers had been supplanted by Englishmen, and this change was greatly due to the influence and genius of the late Alfred Stevens. Having gone as a boy to Italy, Stevens spent thirty years there, and on his return to England obtained employment as one of the masters at Somerset House. On the reorganisation of the school he found it necessary to seek employment, and a Sheffield manufacturer had the wisdom to secure him as his chief artist, on the

* It has been suggested by Sir Philip Owen that an official list of students who have passed through the schools, showing the certificates they have gained, should be periodically published, and this might be made the medium of much useful and interesting information.

recommendation of Mr. Young Mitchell, the head master of the local School of Design. Mitchell and Stevens became fast friends, and the latter thus exercised an indirect influence over the school, for the accommodation of which a new building was erected at great cost. The School Committee was originally composed of *dilettanti*, the manufacturers being conspicuous by their absence, but now the latter take their full share in the government of the school. There is not a single French designer in the town, only two French chasers, and the leading manufacturers (especially those who produce the most artistic works) and general public are greatly interested in the school, many past students of which are occupying honourable positions elsewhere. In Nottingham, twenty years ago, the lace designs, most of which were produced by foreigners, were as a rule lamentably deficient in artistic taste, although there were some good ones amongst them. Sprawling palm trees, nondescript flowers, and absurd ornaments, were huddled together in ugly confusion, and any attempt to leave the beaten track was regarded with disfavour, except by the Science and Art Department, which afforded great encouragement by its favourable recognition of good work. A School of Design was established in Nottingham in 1843, but very little attention was given to the staple manufacture till 1866, when the school secured the services of a master who established special classes for the study and practice of design. After a time he conceived the idea of basing his pupils' work on good specimens of old hand-made lace, English and foreign, which were modified to suit the capabilities of the machine, and this in its turn was improved so as to be capable of producing larger designs for curtains, &c., without "repeats." The students were encouraged by money prizes to do their best, and from that period may be dated the extraordinary progress made in the Nottingham lace trade. It was soon found that native talent was quite equal to all the requirements of this beautiful manufacture; periodical competitions in design were stimulated by local prizes; English designers

gradually superseded foreign artists; and in 1878 the undoubted merits of their work received recognition in the French capital itself, in the shape of a "diploma of honour" from the Paris Exhibition. One of the leading manufacturers of Nottingham, a warm supporter of the School of Art, states that whereas only ten years ago he paid from £1000 to £1200 a year for French designs and to French designers, his present expenditure in that direction is not more than £50. Probably 1500 young men are now engaged in that town as designers and draughtsmen, with such success that in Calais, the chief seat of the French lace trade, the manufacturers last year petitioned the Government to assist them in establishing a School of Art there, lest they should be left behind in the competitive race. Many of the Nottingham manufacturers compel their apprentices, by a clause in the indentures, to attend the School of Art three times a week, a course which is more or less adopted in Aberdeen, Bath, Barrow-in-Furness, Hanley, Preston, and other places; indeed, the School is one of the most popular institutions in the town, and has, moreover, an invaluable adjunct in the museum established in Nottingham Castle. One firm alone pays as much as £5000 a year to seventy designers, including apprentices; and though many designs are still sent over from Paris, they are always put into the hands of English draughtsmen before being put on to the machine. At Macclesfield, where the silk manufacture is the staple industry, the business of hawking French designs is gradually dying out, and only the other day a dealer in these commodities offered one of the students of the School of Art regular employment in sketching and designing, besides which it is well known that a large percentage of the "new French patterns" which arrive quarterly from Paris are really the production of English looms. The Macclesfield School is indeed found to be indispensable to the manufacturers of the town, amongst whom may be found seven or eight ex-students, and the designers trained therein work also for the cotton, linen, silk, and woollen

textiles of other towns. Designs are wanted for almost everything that Macclesfield produces, and it is found here, as elsewhere, that the school course provides higher standards of excellence than are demanded by the customers for whom the manufacturers have to provide. The ability of the students is, however, utilised as fast as they can be trained, and it is expected that the demand will be further stimulated when a technical school is also established, and gives instruction side by side with its artistic neighbour. At Belfast the artizan classes are most numerously attended, and the trades of the town, including linen damask weaving, cotton printing, embroidery, iron-work (wrought and cast), lithography, and engraving, have all been directly benefited; most of the designers have been trained therein, several having also had the advantage of a course of study at South Kensington; and the students include a large number of persons employed in the establishment of Messrs. Marcus Ward & Co. It is, however, regretted that the staple production of the town (linen damask) has not been more largely affected by the work of the school, for though the patterns show a marked improvement, many of them are still execrably bad. A local museum of art objects, and especially of textile fabrics, is greatly needed, for the place is singularly devoid of artistic objects and influences, and as the Free Libraries Act has recently been adopted by the town, it is hoped that steps will soon be taken to establish such an institution. At Birmingham great strides have been made in art-manufactures during the last thirty years, public taste has been largely developed, and designers and art workmen trained in the School of Art are now generally employed. Here, owing to the nature of the trades carried on, there is a great demand for good handicraftsmen, and one of the principal firms, which formerly employed many foreign designers, modellers, chasers, &c., now relies almost exclusively on native ability. At Coalbrookdale the modellers and most of the designers for ironwork are or have been students of the School of Art, and the same may be said of the tile factories of Messrs. Maw and others. At Glasgow

the majority of those filling important posts in the factories have had the benefit of its training, and it is to be hoped that the town will not allow an institution of great value to its manufactures to continue so badly housed as it is at present. At Manchester some of the manufacturers are earnest supporters of the school, but complaints have been made that its work is not sufficiently comprehensive, being at one time too exclusively an Art School, and at another, too much a School of Design: it is, however, now making good headway, and increasing its hold on the estimation of the public. At Stoke-on-Trent the School of Art had, in its earlier years, a staunch and generous supporter in Mr. Herbert Minton, who insisted that his apprentices should attend its classes, and paid the fees of the girls during five years of their apprenticeship. His successors still insist on the attendance of the boys, and the school has turned out skilful workmen for the factories in large numbers, besides which ex-students are to be found in the several establishments, engaged as directors, painters, or designers, and in many cases they have superseded foreign aid. Pottery painting at Stoke has entirely changed its character since the establishment of the School of Art, so far as its technical treatment is concerned, and the school has produced hosts of art-workmen. At Halifax, sixteen years ago, all the principal appointments as designers were held by foreigners; now, however, matters are altogether changed, for they are almost exclusively filled by ex-students from the School of Art, which is also largely attended by youths whose business it is to transfer to "point" or squared paper the designs of their masters, so that a thorough acquaintance with freehand drawing is highly essential to success. At Lambeth a most important and extensive art-manufacture owes its very existence to the influence of the neighbouring School of Art, cordially welcomed and allowed free scope through the enterprise and encouragement of Messrs. Doulton, whose art-pottery is distinctly original in conception and treatment. The Lambeth School always had a class of

design, and about the year 1865 it occurred to Mr. Sparkes, then its master, that the students might as well make their designs in enamelled colours on the clay used for making tiles and other coarse ware, as upon paper in water-colours. He thought this course would add interest to the work, but had no conception of the extensive industry to which the experiment would lead. This beautiful and popular ware, as Mr. Sparkes observed in a lecture delivered in 1880 at the Society of Arts, is—

"A most excellent result of a genuine experiment made with the capital and artistic taste of a manufacturer, developed by purely local means. No local school in any part of the Continent could have done more than the Lambeth School has done to back up by its best efforts the demands made from time to time by Mr. Doulton. . . . It is a truly national production, and at the same time a local one, the direct outcome of the proper co-operation that ought to exist between Schools of Art and local manufacturers."

This modern development of industrial art, in which some 350 persons are employed, mostly females, could not have taken place but for the neighbouring School of Art, which has supplied, almost without exception, the entire staff of the establishment, and continues to have the warm support of Messrs. Doulton, who, as one means of encouragement to the students, arrange that every certificate gained at the School shall carry with it an increase of salary. The School of Art at Stourbridge, also, has had much influence on the glass manufactures of the district, and appears to have founded one important branch, etching on glass, which was started about twenty-five years ago. Cameo glass cutting has also been recently introduced, and great strides have been made in this, as well as in other departments of the trade. In support of this statement the following passage may be quoted from an address delivered by Sir Rupert Kettle, at the last Social Science Congress:

"Without speaking of the special manufacture revived in Venice, I can say with confidence that no country has at any time produced such pure brilliant flint glass as the English makers now give to the world.

As to design, whether in cut, engraved, or moulded glass, whether in rock, crystal, or cameo work, no such art glass was ever before seen as that which is now being produced in my own neighbourhood."

Notwithstanding such testimony as this, it has been objected that Schools of Art have hitherto but imperfectly accomplished their aim, in the application of design to the manufactures of the country—that they have not been sufficiently technical in their teaching. But it should be borne in mind that technical work has always been discouraged by Parliament, on the ground that the public money must not be employed to subsidise trade in any way, and has also been strenuously opposed by manufacturers—who are now clamouring for its greater encouragement—and therefore schools that have developed into technical schools have done so on their own responsibility, and solely by means of their own pecuniary resources; those works only have had any claim to Government reward or encouragement which were strictly within the limits of the Art Directory, quite irrespective of questions of technique. It has already been mentioned that at one time a Jacquard loom was introduced into the schools, and from time to time various attempts have been made to establish classes for wood-engraving, chromo-lithography, pottery, &c., but as soon as these reached the point at which they became useful it was thought expedient to restrain their operation, because of possible interference with trade. In a very important sense, however, the schools are technical schools. Technical drawing is that which has relation to trade industries, whether mechanical or artistic, and, viewing the question in this light, it may be said that all the schools teach technical drawing, for work done with the aid of instruments, and all freehand drawing, essentially underlie all trade drawing; and it is the commonest thing to hear that workmen who have attended the drawing classes are preferred above those who have had no such opportunity, because they are able to work from drawings. Even a slight acquaintance with practical geometry is of the utmost service to working

engineers, smiths, builders, zinc workers, boiler-makers, cabinet-makers, masons, shipwrights, workers in mosaic and marqueterie, &c.; and in like manner freehand drawing lies at the root of all designing for wall-papers, carpets, cretonnes, damasks, silks, and other textile fabrics; also of all inlay work, such as enamelling, mosaics and marqueterie, much furniture, bookbinding, embossing, engraving, glass-painting, pottery-painting, and other industries; whilst the practice of modelling is the basis of all good carving in marble, stone, or wood, of iron and brass founding, pottery, &c. All this elementary teaching is essentially technical, and would have now to be undertaken by the City and Guilds of London Institute, established by the Livery Companies in 1877 and incorporated in 1880, for the purpose of providing technical education for the industrial classes, if it were not already accomplished by the Schools of Art.* The City and Guilds of London Institute has erected a central establishment in Exhibition Road, South Kensington; has granted for a period of years subventions for the formation of technical classes in London and the principal manufacturing towns; and has taken in hand and further developed the technological examinations established in 1856 by the Society of Arts. It is hoped that it may be the means of supplementing and enforcing the good work accomplished by the Schools of Art; and that the two organisations may derive reciprocal advantages from their operations.

The very important influence of Schools of Art, in elevating the public taste by means of amateur students,

* One branch of technical instruction received a great impetus in 1870, in the endowment by Sir Joseph Whitworth of thirty scholarships of the annual value of £100 each, for the purpose of promoting the engineering and mechanical industry of the country by the further instruction of young men, natives of the United Kingdom, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and its cognate sciences. In addition to this munificent foundation, Sir Joseph also gave sixty exhibitions of £25 each to the principal universities, colleges, and public schools, to induce young men to prepare for the first competition.

has been already dwelt upon, and the service thus indirectly rendered to the country has not been sufficiently appreciated by those who would discourage their admission. In many country towns where schools exist there are no manufactures at all, and consequently the proportion of amateur students is here much greater than in large commercial centres. But the tenacity with which Art is adhered to for its own sake, as a graceful accomplishment, or because of the pleasure it may be the means of affording, makes it impossible to predict what may not spring from the cultivation of the germs of artistic feeling; and it is not a reproach, but a pride to Schools of Art, if they are the means of developing such ability wherever they find it, whether in the art-smith whose trained eye and hand and judgment enable him to produce, and even to refine the beauty of a drawing; in the artist by whose inventive faculty and educated skill the design is produced; in the lady amateur who spends her leisure in the artistic gratification of herself and her friends; or in the few students of high mark who are led on and encouraged until they find their way to the honours of the Royal Academy. The production of a true artist, whether of the humblest or of the most elevated class, must be a distinct gain to the nation; but the public only pay on the results gained by the work of artizan students, so that all that is done, outside the prescribed limitations of the Government grants, is done at the cost of the school, or of those who contribute to its income by the payment of fees. To afford opportunity for the development of the highest skill in designing and in Fine Art, classes should exist in all schools for the study of the human figure in drawing, painting, and modelling, and every effort should be made to detect talent, that the country may not sacrifice by neglect the latent powers of a gifted man. To show that the schools have in this way been most useful in the higher branches of Art, it will perhaps be sufficient to mention the names of W. C. T. Dobson, R.A. (Somerset House); E. J. Poynter, R.A. (Somerset House); H. H. Armstead, R.A. (Somerset House); W. W. Ouless, R.A.

(Lambeth); H. Herkomer, A.R.A. (Southampton): E. J Gregory, A.R.A. (Southampton); Luke Fildes, A.R.A. (Chester); H. Woods, A.R.A. (Warrington); Mrs. Butler (South Kensington); Mrs. Allingham, J. D. Watson, C. E. Johnson, Clarence Whaite, S. Sidley, Edwin Bale, Wilmot Pilsbury, J. Parker, C. P. and F. A. Slocombe, H. A. Gribble, and others, all of whom in the earlier stages of their career were under instruction in the Schools of Art. To enumerate all the ex-students who have attained honourable distinction would be altogether impracticable, but it may be stated that they also include the late Godfrey Sykes, one of the most admirable decorative artists the schools have produced; George Tinworth, the development of whose singular gifts as a sculptor of Biblical subjects is a lasting honour to the Lambeth School;* Leonard Wyon and George Morgan, the latter of whom fills a position at Philadelphia similar to that which the former occupies in England; F. W. Moody, to whose skill and fancy much of the decorative work at the South Kensington Museum is attributable; Hugh Stannus, who was appointed to complete the Wellington monument after the death of Mr. Stevens, and is now engaged in working out experimentally a modification of that artist's design for the decoration of the cupola of St. Paul's Cathedral; and a host of other exponents of English art. Indeed, the work of the schools, while earnestly and persistently directed to its primary object—the improvement of our manufactures—is well engaged in the incidental encouragement of any kind of artistic talent, and it would not be wise to place too tight a rein on the direction it may be disposed to take. As Sir Henry Cole observed, some years ago, in one of his speeches, the Schools of Art "were never meant to produce artists in the narrow sense of the word, any more than we expect elementary schools to produce

* The Lambeth School has produced four Gold Medalists of the Royal Academy—Claude Calthrop, Percival Ball, Samuel M. Fisher, and H. H. La Thangue. Charles Roberts, wood engraver, was also one of its students.

poets;" but it is a boon to a nation, and to mankind in general, when great powers become developed by means of genial influences, even as Giotto de Bondini was taken by the hand by Cimabue, and rose from the position of a shepherd-boy to become a great artist and the friend of Dante.

THE NATIONAL ART TRAINING SCHOOL AND NATIONAL SCHOLARSHIPS.

In the National Art Training School technical matters connected with various art industries always receive attention in the lectures on design, and the provincial masters, many of whom are acquainted with the technique of several trades, do their best to meet the needs of local manufactures; if they do not acquire sufficient technical knowledge to make their schools useful, the School Committees have the remedy in their own hands. The National Art Training School is now so much in demand—there are at the present moment 710 students on the books (310 males and 400 females), including 17 National Scholars, 32 artizan students who attend the evening classes, 12 schoolmasters, and 8 schoolmistresses—that additional accommodation is much needed, and several more studios might be utilised. The greatest good-fellowship exists among the students, who have various accessory organisations for cricket, boating, music, &c., and in October a holiday sketching club produces some 700 or 800 works for adjudication. At Halifax and other places there are also art clubs in connection with the Schools of Art, and the members are from time to time represented on the walls of the Royal Academy. It may be added that the students of the National Art Training School are invited to the Royal Academy lectures, and the Academy in return receives from the Schools of Art some of its most promising recruits. It has been suggested that the training imparted in the schools should lead up to a certificate or degree, which should be to the student a

recognised stamp of merit akin to that which is conferred at the Universities for scholarship: such a distinction would be both acceptable and useful, and the proposal is deserving of consideration. (See Appendix F.)

The National Scholarships, of which there are twelve, were established to enable advanced students, who have given evidence of special aptitude for design, to prosecute their studies for a time in the Training School and Museum at South Kensington. The competition for these scholarships takes place in February and September, and students already engaged in designing for or producing works of art-manufacture are regarded as the most eligible candidates. When elected they receive free instruction, and allowances for maintenance varying from 20*s.* to 40*s.* a week, according to their merit, and they generally remain at South Kensington two years; the appointment may be renewed for a third year in cases of great proficiency. National scholars and students in training may also in special cases receive grants to assist them in visiting foreign schools and galleries.

From 1863 to the present time 145 National Scholars, including five female students, have been received at the National Art Training School. Of this number 90 left it to enter upon engagements as designers, modellers, draughtsmen, decorators, &c., in connection with various art industries; 9 were employed in the like capacities by the Department of Science and Art; 14 received appointments as masters or assistant masters of Schools of Art; 2 met with their death by drowning, in one case while attempting to rescue a fellow-creature; 2 died, 2 resigned, and 1 was dismissed before the period of training expired; respecting 8 others there is no information; and the remaining 17 are still in training at South Kensington. (See Appendix G.) Of those who steadily devoted their attention to the object for which they were trained many have since become distinguished for the excellence of their work, a fact which is the more gratifying when it is remembered that they have for the most part risen from a comparatively humble position.

The following table shows the Schools of Art from which the National Scholars have been supplied :—

Schools of Art.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	Total.
S. Kensington	–	–	1	2	1	2	2	1	4	1	1	2	1	–	–	1	2	–	2	–	2	–	25
Birmingham .	–	–	–	1	2	1	2	2	1	1	2	–	2	–	–	1	–	–	1	1	1	–	18
Stoke-on-Trent	–	–	–	1	–	1	–	–	–	1	–	–	–	–	1	–	–	–	–	1	1	–	} 12*
Newcstle. Staff.	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	2	–	–	1	2	–	–	
Belfast . . .	–	–	–	–	–	–	–	–	–	–	1	1	1	1	–	1	1	–	1	–	1	–	8
Coalbrookdale	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	1	1	1	6
Metropolitan .	–	2	1	1	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Sheffield . .	–	–	–	1	1	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	6
Warrington .	1	–	2	–	–	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–	–	–	6
Burslem . .	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	1	–	–	5
Cirencester .	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	4
Halifax . .	–	–	–	–	1	–	2	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	4
Nottingham .	1	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	4
West London .	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	1	3
Bristol . . .	–	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	–	–	–	–	–	3
Charterhouse .	–	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Frome . . .	–	–	–	–	–	–	1	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	3
Hanley . .	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–	–	–	–	–	–	–	–	3
Kidderminster	–	–	–	–	1	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	3
Gloucester .	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	2
Newcastle-on-Tyne .	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	2
Worcester . .	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	2
Preston . .	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2
Yarmouth, Gt.	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2
Bath . . .	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Coventry . .	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Dublin . .	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Lambeth . .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
Leeds . . .	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Limerick . .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Liverpool . .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Salisbury . .	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Spitalfields .	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Stroud . . .	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Torquay . .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Westminster .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
York . . .	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1

* The Schools of Art at Stoke-on-Trent and Newcastle-under-Lyme are bracketed together, as they have been continuously under one master.

THE SOUTH KENSINGTON MUSEUM.

In a work designed to record the progress of our Schools of Art, distinct and prominent mention should be made of the inestimable advantages derived by students from the superb collection of examples, in all departments of art-workmanship, to be found in the South Kensington Museum. To state that the Museum contains priceless treasures handed down to us from mediæval times and the still remoter past, in the precious metals, in bronze, in sculpture, ceramics, textiles, &c.; that it is equally rich in more modern examples, gathered from every quarter of the globe; that, in addition to the objects permanently acquired, the glass cases of the Loan Court are continually being replenished with the choicest objects from private collections; that special loan exhibitions of the highest interest have frequently been held, illustrating particular departments of art industry; that there is connected with the Museum an art library of 50,000 volumes, with a most extensive collection of drawings, prints, and photographs; and that all these are accessible to the public on the easiest and most inviting conditions, is to give but an outline of the advantages conferred by the South Kensington Museum—and, in a degree, by the offshoot at Bethnal Green, to which the more modern objects, of a date subsequent to 1851, are consigned—not only upon Schools of Art, but upon manufacturers and the public at large, by keeping constantly before their eyes a series of objects of the highest value, as examples to be followed and emulated by those who desire to attain eminence in design or workmanship. Here, again, England has been as far behind other nations in point of time as she has been rapid in the accumulation of a collection which in some departments is unequalled for its excellence. Some continental States were well in advance of us in this respect, until Sir Henry Cole set himself to the accomplishment of what became the chief aim of his life—the creation and extension of the

Museum over which he so long and so efficiently presided, and in the direction of which the country has for the last ten years had the advantage of the services of an equally able and earnest successor in Sir Philip Cunliffe Owen.

Under a minute of the Education Department prepared in 1862, at the instance of the Right Hon. R. Lowe, it was directed that purchases for the Museum should be "confined to objects wherein fine art is applied to some purpose of utility, and that works of fine art not so applied should only be admitted as exceptions, and so far as they may tend directly to improve art applied to objects of utility"; and the Parliamentary grants, sometimes bestowed with too niggard a hand when "sparing at the spigot" has been the economy of the hour, have accordingly been expended with great care, the fine art collections to be found in some of the galleries being special gifts and bequests to the nation. From time to time there have been those who have complained of the outlay on the South Kensington Museum, but it would be difficult to point to any item of public expenditure that has been more fruitfully productive, for it has been the means of inducing patriotic donors to add to its collections gifts of inestimable worth in an artistic sense, and of great intrinsic value. In his report for the year 1882, Sir Philip Owen, recording the acquisition of the superb collection bequeathed to the nation by the late Mr. John Jones, of Piccadilly, stated that it had been valued by experts at a quarter of a million sterling, a sum which, at the time when the bequest was received, had been but slightly exceeded by the national outlay on original art objects from the beginning of the Museum collections in 1852. And this is only one of many gifts, amongst which may be mentioned Mr. J. Sheepshanks' gallery of pictures by British artists, valued in 1870 at £90,000; the bequest of the Rev. Chauncy Hare Townshend, consisting of paintings, gems, precious stones, cameos, prints, &c., valued at £23,000; the bequest of the Rev. Alexander Dyce, including paintings, miniatures, drawings, engravings, manuscripts, and upwards of 13,000 printed books, valued at

£20,000; and Mr. John Forster's library and collection, a bequest of the highest literary interest. The goodwill of various foreign nations has also been manifested by the gift of some important contributions, such, for example, as the historic collection of Japanese pottery and porcelain, formed by the Japanese Government expressly for this Museum. Thus, whilst its educational value cannot well be over-estimated, those who bring everything to the test of market value have the satisfaction of knowing that the Museum is at the present moment worth more than twice as much as has been paid for it. It should also be stated that its usefulness is extended to the provinces, by loans of objects to local museums—of which several have been established, mainly through the instrumentality of Sir Philip Owen—and to art exhibitions, and thus their influence on public taste is greatly extended. Reciprocal arrangements are also made by which there is a courteous and serviceable interchange of artistic loans between this country and continental states.

The advantages conferred by the Museum on distant localities, by the circulation of selected objects of art-workmanship, are very great and increasingly acceptable. The Museum, opened at Marlborough House in 1852, was removed to South Kensington in 1857; but previous to this (in 1855) a small but comprehensive collection of about 430 specimens of art-manufacture, and 150 framed drawings and photographs, was formed and sent successively, in that year, to Birmingham, Nottingham, Macclesfield, Norwich, and Leeds. This collection continued in circulation until the close of 1859, and a second collection, formed in 1860, remained in circulation until the middle of 1863. In February 1864 it was decided that all works exhibited in the central Museum which could be lent and removed with safety, should be available for temporary exhibition to the public in local Schools of Art; thenceforth the system of making a special selection of objects for each loan-collection sent out has been uniformly pursued, and its advantages have been extended to institutions

unconnected with the Department, each application being considered on its merits. During the seventeen years 1864–1880 no fewer than 258 collections were thus sent out from South Kensington, many of them as loans to permanent museums, and in most cases they were largely supplemented by other loans of art objects drawn from the neighbourhood in which each exhibition was held. In this, not the least important branch of its operations, the great art-storehouse at South Kensington widens the scope of its influences, and extends the inestimable benefits of its teaching.

In another respect, also, the South Kensington Museum is inseparably associated with the Schools of Art, or rather with the National Art Training School, for the decorations of the building are, to a great extent, the work of men whose skill was developed by its teaching. Of the full-length figures in mosaic, which adorn the interior of the central or loan court, Phidias and Apelles are by E. J. Poynter, R.A.; Raphael and Michael Angelo, by the late Godfrey Sykes; Palissy, by R. Townroe; Della Robbia, by F. W. Moody; Jean Goujon, by H. A. Bowler (now Assistant Director for Art); and Inigo Jones, by Morgan, all of whom received their early training in the School; whilst others are by Sir Frederick Leighton, P.R.A., E. Armitage, R.A., and other artists of eminence. Godfrey Sykes, whose decorative skill was of the highest order, and who received his early training in the Sheffield School, died young in 1866,* and much of his work in the Museum, the

* The thirteenth report of the Department, noticing the early death of Mr. Sykes, who within three months followed to the grave the engineer and architect of the Museum, Captain Fowke, R.E., with whom he had necessarily been very closely associated, says :—" In the various reports of the Department it has been pointed out how much was due to these gentlemen : how successfully the one by his scientific attainments, combined with a mechanical genius and boundless ingenuity and fertility of resource, in grappling with the hitherto unsolved problem of a useful and harmonious employment of iron in architecture, and the introduction of new forms and new materials adapted to the atmosphere of London ; how the other was impressing on those materials a decoration both of colour and form, no less

Horticultural Gardens, and elsewhere, was completed by Messrs. Gamble and Townroe, his pupils. The large panels in the grill-room, representing the Months and Seasons, are from designs by Mr. Poynter, executed in glazed tiles by female students of a porcelain class, at one time carried on at South Kensington ; and the original drawings, together with another design by Mr. Poynter for the soffit of the arch in the lecture theatre, are now to be seen in the Schools of Art section of the International Health Exhibition. Some of the pictorial adornments are by artists unconnected with the schools, such, for example, as Sir Frederick Leighton's admirable frescoes, "The Arts of War" and "The Arts of Peace," the latter of which is not yet finished, and the paintings in the lunettes of the galleries now occupied by the Jones collection, by Pickersgill, Leslie, Marks, Prinsep, Yeames, Eyre Crowe, and other artists ; but, generally speaking, the decorations of the Museum,—the ceilings, wall-panels, friezes, staircases, columns, &c., of the interior, the sgraffito work and other adornments of the exterior—have been executed by National Scholars, chiefly from the designs of F. W. Moody, a fitting return on the part of those who owe so much to its teaching.

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artistic than original, and with an energy and untiring industry, undaunted by years of suffering and lingering disease, worked on almost to the day of his death, founding, it may be hoped, a new school of decorative art." Shortly after the death of Mr. Sykes an exhibition of his works was held at South Kensington.

CHAPTER IV.

Helps and Hindrances.

In one important respect Schools of Art have a marked advantage over many institutions, inasmuch as they are unaffected by political differences or sectarian prejudices, and class distinctions are ignored in the recognition of artistic capacity. And where Schools of Art have been established long enough to make the effects of their teaching felt and understood, there is, on the whole, a friendly feeling towards them on the part of the inhabitants, who in some places accord their hearty and most generous support. The Manchester Corporation has recently shown its appreciation of the School of Art by taking it into its own hands, and will in future provide for its wants, and for those of an Art Museum. The new school has been erected in the most central situation, the cost of the building and site, about £30,000, being defrayed by the munificence of three of the townspeople, in addition to which upwards of £20,000 has been subscribed to provide objects for an Art Gallery and Museum, now nearly completed. The general feeling of the town is shown by the circumstance that though the Consolidation Bill, by which the requisite powers were obtained for these purposes, encountered much opposition in respect of some provisions, the clauses relating to the School of Art, Art Gallery, and Museum, met with unanimous approval. At Falkirk the school has been so highly appreciated that in 1878 a new building was erected for its accommodation at a cost of about £3000, the whole of which was raised by subscription in the course of a few weeks; at Warrington a similar

amount has been recently raised by the townspeople for the erection of a new school; the School of Art at Derby was erected by public subscription, at a cost of about £15,000; at Aberdeen the head of a local firm of engineers has presented the town with a new school, which has cost about £5000; at Barrow-in-Furness a school has been similarly erected at the expense of a generous donor; at Tiverton, where the local subscriptions supply a handsome prize-list for the students, the inhabitants are now endeavouring to raise £1200 for the purchase of the school, and have recently provided funds for an art-library; at Gosport the School Committee raised about £100 last year as a special subscription towards furnishing a new school;

ERRATUM.

Page 844, line 12, *for* "Manchester" *read* "Birmingham."

even where abundant means and the prestige of past reputation for honest workmanship would justify higher and bolder aims; and the too common desire to repress all individuality in designers and art-workmen is greatly to be regretted. Many excellent drawings are completely spoilt by alteration or combination, simply in order that designers may not be able to lay claim to them, and occasionally the process is so effective that only *disjecta membra* can be identified. Many illustrations might be given of the want of interest displayed by manufacturers, but one instance must suffice. Not long ago, an artizan student at a School of Art designed a fabric, and asked his employers to weave a portion for a competition. The request was refused, whereupon he took his design to another firm, paid for its

production, gained the sought-for prize as well as a prize from South Kensington, and is now employed as designer to the manufacturers who wove the piece. Had he been less determined, he might still have been serving his former employers as a weaver; had they been more liberal-minded they might still have enjoyed the advantage and profit accruing from the exercise of skill in the development of which they refused to assist. As an example of the ignorance to be encountered, it may be stated that not long ago an iron-founder, speaking at a public meeting on the superiority of the nineteenth century over any previous age, said that his men could put up a pair of gates in as many days as it took years to complete the Ghiberti gates! Nothing less than Sydney Smith's "surgical operation" would suffice to get any idea of art into the head of a man of this stamp; and though the case is doubtless an exceptional one, the feeling of many manufacturers towards art in its relation to their productions is certainly very capable of elevation.

Although the advance already made receives cordial recognition abroad,* and we are gradually becoming alive to the truth that foreign work in design or execution is not necessarily in admirable taste, hankering after Continental "novelties" is by no means extinct amongst us, and receives no little encouragement from the manufacturers themselves. Sir Philip Owen, in an address recently delivered, said that some few years ago he presented the prizes at a School of Art, and one of the recipients was a designer, who entered the service of a Parisian firm at a salary of £400 a year. While he was at home this young man made a great many designs, without finding any one who would take them up; but as soon as he went to Paris the manufacturers followed him there, and paid him ten times the amount they would have had to give for his

* In furniture especially the *style Anglais*, as it is termed by our neighbours, is warmly appreciated, and Frenchmen come to England and make most extensive purchases to meet the modern Parisian taste.

designs in England. From the first establishment of the schools to the present time—though in a gradually decreasing proportion—manufacturers have spent much money on foreign designs, many of them done by English hands, which might have been more economically laid out at home, both in a personal and in a national sense; and several instances could be mentioned in which artists of very high merit, unable to find employment in the home market, have attained abroad a position there recognised as eminent.

Ungenerous disparagement of the Schools of Art and of their teaching has also had its hindering effects. In spite of abounding evidence to the contrary, men are sometimes heard to declare that the schools have failed in their object, and that manufacturers in want of designers apply in vain for qualified and capable students. Cases are, however, known in which fabricators of such statements have persistently rejected designers of ability who have applied to them for employment, until they have at last been brought to admit that they had no such requirements. And where designs have been submitted for acceptance, it has occasionally been ascertained, by means of precautions previously taken, that those who rejected them as valueless have, nevertheless, been mean enough to take tracings of them before sending them back. Therefore, when disparaging statements are made respecting the schools and their teaching, the public will do well to contrast them with the incontrovertible evidence afforded by their marked effects on local industries and art-manufactures generally, as they are practically exemplified in the admirable display to be seen in the gallery devoted to the work of the schools in the International Health Exhibition.

It may be hoped, however, that detractors and opponents are in a constantly decreasing minority. In many towns the beneficial operation of Schools of Art is warmly acknowledged and encouraged, both by manufacturers and by the general public. Many firms insist on the attendance

of their apprentices at the evening classes, and make this a condition of their indentures, sometimes paying the school fees, and contributing also to the local subscription in aid of its support. Such subscriptions are, however, by no means so general or so liberal as they ought to be. It has been shown that in some places the inhabitants have been most generous in providing for the erection of Schools of Art, Museums, &c., and in many others, especially the smaller towns, the local subscriptions are fairly liberal, sometimes approaching the amount of the aid received from Government; but there are large towns in which not a single penny is subscribed even for local prizes, which are occasionally provided by the art-master out of his own stipend, and in others the amount subscribed is ridiculously small considering the wealth of the locality and the dependence of its staple industry on the education of the designer and art-workman. Local prizes are greatly needed as an inducement to exertion, especially in schools that have little or no chance of success in the National Competition. The influence of this annual trial of strength is variously regarded, the successful schools being warm in praise of its invigorating influence, whilst those who win no share in the honours bestowed have a tendency to underrate their worth. But there can be no doubt of the advantages of a general competition of this kind, and any attempt to extend the number of prizes,* or to make them more easy of attainment, would necessarily have the effect of lowering their value as marks of distinction. It might, however, be advisable to extend the scope of departmental

* The present awards include twelve gold medals for the best drawing from the nude living model, for the best study from the antique in chalk, for the best study of the figure modelled in plaster from the antique, for the best study of drapery, for the best painting (in oil) of a group from still life as a composition of colour, for the best painting (in water colour) of a group from still life as a composition of colour, for the best painting (in oil or water colours) of a head or nude figure from nature, for the best painting in monochrome from the antique, and for the best designs, architectural, surface, and plastic. Thirty silver and sixty bronze medals are also awarded.

reward, so as to bring within its range the work of schools which are practically outside the pale of the National Competition. But it should be the business of each particular locality to recognise and reward the merit of students, in all stages of their training. The value of competition, as a stimulus to application, cannot well be over-estimated, and local prizes keep alive the interest of students, especially of the younger ones, who have to wait a long time for success in the higher grades of their art. Liberal encouragement is therefore of much importance, and the public would do well to bear in mind the words of the wisest of men: "There is that scattereth, and yet increaseth; and there is that withholdeth more than is meet, but it tendeth to poverty."

In addition to those already mentioned, there are various minor hindrances that may be briefly glanced at, such as the vicious and vulgar admiration for what looks "rich" and costly, rather than for what is artistic; the extravagant expectations and consequent disappointment of people who look for the prompt conversion of their children into draughtsmen and painters; the absence of any definite object in towns where design is not required for the local industries; and the lack of sympathy experienced in some places by teachers, who long in vain for countenance and encouragement in their work. There are also internal hindrances, amongst which may be admitted mistakes in central government and local control, to be obviated only by the corrective influences of time and experience, which are not rapid in their action on departmental arrangements; the tendency of students to adopt Fine Art as a profession, either as a ready means of earning a livelihood, or under the mistaken supposition that it is better to be an indifferent "artist" than a good designer or art-workman; incompetence and want of tact on the part of teachers—for in art, as in scholarship, though men of high attainments are comparatively abundant, really good teachers are rare; the insufficiency or unsuitability of school buildings, which in some places are greatly in need of improvement; the too

general avoidance of time studies in the provincial schools, notwithstanding their paramount value in the rapid development of ability, as distinguished from elaborate manipulation; and the inability of working students to attend the classes, except at the end of a hard day's labour, when they are naturally inclined to devote their scanty leisure to recreation, rather than to study. Many have to walk long distances to and fro, and though the disciplinary advantages of self-denial are undoubted, their studies might be greatly facilitated by some relaxation of the hours of labour, and it is hoped that the inclination to concede this will become increasingly general. The conventional difference which exists in this country between the social position of the pictorial artist and that of the designer will doubtless be diminished as the art of the latter becomes better appreciated. In France there is a much nearer approximation of the one to the other, and those who confine their ideas of art to that which is known as Fine Art should be reminded that Raphael and Albert Durer, Holbein and Cellini, and Flaxman, are inseparably associated with the art whose dignity and importance they are so apt to underrate. Certainly no designer who aspires to be regarded as a true artist should be ashamed of his vocation, with such imperishable names as these to point the way to excellence.

There are, however, designers and designers, and their earnings have necessarily a very wide range, according to the nature of the industry to which their art is applied. There is in our manufactures scope for the exercise of all degrees of artistic skill, which may be applied to the simple sprig that adorns a cotton print—such as the famous parsley leaf * so closely associated with the fortunes

* Robert Peel's attention was principally directed to the *printing* of calico—then a comparatively unknown art—and for some time he carried on a series of experiments with the object of printing by machinery. The experiments were secretly conducted in his own house, the cloth being ironed for the purpose by one of the women of

of the Peel family—or to some beautiful and elaborate work of art which will claim the admiration of all time. In the lace trade there are designers who receive salaries ranging from £500 to £700, and even £1000 a year, whilst others, working independently for any firm that chooses to employ them, also make large incomes by their skill. Good textile designers, even without marked genius, command from £100 to £300 a year, whilst the salaries of others of inferior mark range as low as £70. The earnings of designers of wall-papers vary from £3 to as much as £20 a week, but this maximum is of course but rarely touched. In calico printing and many other trades the salaries paid are by no means high, generally about £2 a week, but it is difficult to quote figures, which must be altogether dependent on the nature of the work and the ability of the designer, and, in a measure, on his quickness also. Unfortunately even capable designers frequently find encouragement in their art so slow and precarious that they are compelled to have recourse to teaching, picture-making, or some other means of providing for their necessities; and cessation of employment, in some departments of art-manufacture, not unfrequently results from their own success, for (in textiles especially) the necessity for fresh designs is in an inverse ratio to their acceptability; manufacturers are of course only too glad to keep their

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the family. It was then customary in such houses as the Peels' to use pewter plates at dinner. Having sketched a figure or pattern on one of the plates, the thought struck him that an impression might be got from it in reverse and printed on calico with colour. In a cottage at the end of the farmhouse lived a woman who kept a calendering machine; and, going into her cottage, he put the plate, with the colour rubbed into the figured part and some calico over it, through the machine, when it was found to leave a satisfactory impression. Such is said to have been the origin of roller printing on calico. Robert Peel shortly perfected his process, and the first pattern he brought out was a parsley leaf; hence he is spoken of in the neighbourhood of Blackburn to this day as "Parsley Peel."—*Self-Help*, by Samuel Smiles.

looms engaged in the execution of a particular pattern, until the demand for its production ceases. The deficient cultivation of the purchasing public is still much felt, not only by manufacturers, who frequently meet with a slow demand for their most artistic productions, and are thus discouraged in their attempts to lead the public taste, but also by the more capable designers, who find themseves in advance of the market, unable to obtain the employment for which they are best fitted.

At a time when most strenuous efforts are being made in foreign countries to bring art-teaching to the highest pitch of excellence, it is more than ever desirable that no opportunity should be neglected, or rather, that opportunities should be sought, for the improvement of our systems of instruction and management. Many masters of Schools of Art occupy a position of isolation,* the narrowness of which has its effects on their work; and, as a counteracting influence, it would be very advantageous if arrangements could be made so that they might have an opportunity to spend a week in London during the summer holidays, in order to take part in an annual conference with the officials of the Department on subjects relating to the work of the schools, and at the same time

* A master of a School of Art thus gives vent to his despondency:—"There are no manufactures here, nor design that I know of, except bacon and shirts and whisky . . . . No such thing as a good painting was ever done here—speaking generally, at any rate—no one takes enough interest in Art or stays long enough to do much good. Besides, I have a suspicion that I can't be a good teacher in some ways. Never seeing an artist, or a designer, or any one who knows anything of art or design, or of Schools of Art, I feel as if I had wandered to some far-off country, like a lotos-eater—

> "'Sweet it was to dream of fatherland; but evermore
> Most weary seemed the sea, weary the oar.'

What Art is, what it means, how it is ever to be attained, I know not. Far-off echoes come now and again through the *Magazine of Art*, *Artist*, &c., but beyond teaching second-grade subjects I feel as if my hands were paralysed, and my mind also."

gather reciprocal advantages from renewed intercourse with old fellow-students. Might it not be possible, also, to assist a certain number of deserving masters to enlarge their experiences by occasional visits to the schools of France, Belgium, &c.

CHAPTER V.

THE SCHOOLS OF ART SECTION OF THE INTERNATIONAL HEALTH EXHIBITION.

IF the evidence already adduced be insufficient to satisfy some minds as to the great value and importance of Schools of Art to the country, ocular and tangible demonstration of the work they have accomplished may be found in the Central Gallery of the International Health Exhibition. This attractive and extensive display owes its origin to a meeting convened in February last by Sir Philip Owen, who gathered around him a few gentlemen interested in the schools, with a view to decide on the best means of obtaining designs and executed works for the purposes of the Exhibition. As the opening was fixed for the 8th of May, the time for preparation was short, and this was loudly complained of both by manufacturers and students; in some cases the latter declined to send examples of their work, because there was no opportunity for special effort. There is, however, a decided advantage arising from the shortness of the notice, for the display may fairly be regarded as a representative collection of the ordinary work of students and ex-students, and as such it justly entitles the schools in which they have been trained to the grateful admiration of the country. But for various difficulties an exhibition of still greater attractiveness might have been presented. In addition to other drawbacks, the space at command, large as it is, was insufficient for more than one-third of the examples sent for exhibition, and this must necessarily occasion a good deal of disappointment. Nevertheless the display is in the highest degree creditable to the schools and to their students, and whilst it can scarcely fail

to astonish the public by its extent and excellence, it at the same time affords a conclusive answer to those who would disparage their usefulness, or underrate the advance made in recent years in the art-manufactures of the country.

In this display no fewer than 115 Schools of Art (including a few that have become extinct) are represented, and this is a very large proportion, for of the 177 schools now in existence, many are established in towns where there is no local art-manufacture. The collection, which includes some 1500 works, is especially strong in ceramics and lace—departments in which the influence of the schools has been very great, even to the extent of creating new industries—and also in glass, plate, and plated wares, furniture, carpets and tapestry, silks, and ornamental metal work.* The schools at Nottingham, Macclesfield, Lambeth, Sheffield, and Coalbrookdale, in addition to that at South Kensington, are particularly prominent. It is impracticable here to do more than note a few examples, but the following may be taken as illustrating the general excellence of the works contributed, the numbers corresponding with those in the Catalogue :—

SECTION I.—*School Studies.*—Nos. 6, J. Clarke (South Kensington), and 12, G. Bathgate (Edinburgh), studies in chalk from the cast; 14, A. Hitchins (South Kensington), sketch in chalk; 15, Miss Edith Savill (Lambeth), life study in chalk; 20, J. J. Trego (Coventry), outline study from nature; 23, G. W. Rhead, N.S.† (South Kensington), pencil study from nature; 35, S. H. Llewellyn (South Kensington), group in oils; 37, Mrs. Finney (South Kensington), copy in oils; 45, A. G. Morrow (South Kensington), life study in water colours; 50, the same, studies in chalk; 47, G. Hare (South Kensington), life study in oils; 49, A. Hitchins (South Kensington), life studies in oils; 55, W. Adamson (Dundee), study of machinery.

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* An earlier exhibition was held at South Kensington in 1858. (See *ante*, p. 73.)

† Those who have "N.S." appended to their names are National Scholars, and completed their training in the National Art Training School at South Kensington. The schools within parentheses are those in which the students commenced their training.

SECTION II.—*Ceramics.*—No. 160, F. A. Butler (Lambeth), large stoneware vase; 135, W. Parker (Lambeth), vase, repoussé ware; 159, Miss Florence Lewis (Lambeth), large vase, floral decoration; 103, Miss L. E. Edwards (Lambeth), bowl, salt glaze; 65, Miss Louisa Davis (Lambeth), vase, floral decoration; 67, Miss E. Simmance (Lambeth), vase, silicon ware; 82, Miss E. A. London (Lambeth), stoneware vase; 149, Miss Mary Denley (Westminster and Lambeth), vase, conventional ornament; 89, Miss Martha Rogers (Lambeth), flower-pot, salt glaze stoneware; 94, Miss B. J. Youatt (Lambeth), jug, stoneware; 161, Miss Mary Butterton (Lambeth), large vase, floral ornament; 199, J. and S. Callowhill (Worcester), pair of vases, gold decoration; 208, A. Tatler (Burslem), pair of vases, floral decoration; 210, J. Bratt (Burslem), pair of vases; 294, D. Dewsbury (Burslem), vase, gold ground and floral decoration; 259, G. W. Rhead, N.S. (Hanley, Stoke, and Newcastle-under-Lyme), plate, imitation of Limoges enamel; 334, Miss Mary Denley (Westminster and Lambeth), design for china plaque; 340, F. Leighton, N.S. (Coalbrookdale), design for painted tazza; 350, Jas. Boyle (Dublin), design for plate; 361, W. Gandy (Lambeth), design for painted panel; 369, W. H. Woodall (West London), design for tiles; 400, Owen Gibbons, N.S. (Cirencester and South Kensington), decorative panel; 409, E. Jarratt (Coalbrookdale), design for mosaic pavement; 436, F. Lewis (Lambeth), decorative tiles. Messrs. Doulton's pavilion at the east end of the gallery may be regarded almost in its entirety as the product of the Lambeth School of Art, its columns, friezes, hand-painted tiles, and other decorations being the work of its students and ex-students, except the pictorial panels, which are by J. Eyre, N.S., of the Stoke School. The modelling in terra cotta includes several examples (Nos. 162 to 171) of the work of George Tinworth,* of the Lambeth School; they include a classical panel, declined at Burlington House, representing the story of Cydippe and her Sons (No. 162). Also a series of panels (No. 433) representing the Months, modelled by R. J. Morris, N.S. (Burslem), for the Wedgwood Institute at that place.

SECTION III.—*Glass, Cut, Engraved, Painted, &c.*—No. 481, Thos. and Geo. Woodall (Stourbridge), "Dancing Girls"; 451, Thos. Woodall (Stourbridge), vase, cameo cut; 493 and 499, vases, designed by Thos. Woodall (Stourbridge), and executed by J. T. Fereday (Dudley); 513, C. Northwood (Stourbridge), cameo cut vases; 528, F. G. Smith (Lambeth), 530, T. W. Camm (Birmingham and South Kensington), 532, Carl Almquist (West London), and 533, E. Hammond (Lambeth and West London), designs for painted windows.

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* In 1833 a public exhibition of Mr. Tinworth's works in terra-cotta was held at the Conduit Street Gallery. Two of his larger panels, "Preparing for the Crucifixion" and "The Release of Barabbas," are temporarily placed in the South Kensington Museum.

SECTION IV.—*Enamels on Metal.*—No. 548, E. Duffield (Birmingham), large vase, cloisonné enamel; 550, Miss Marianne Mansell (Lambeth), design for casket in champlevé enamel.

SECTION V.—*Ornamental Metal-work.*—No. 619, H. Poynton (Coventry), Piccadilly gates of Burlington House; 579, the same, brass chandeliers; 551, W. H. and E. R. Singer (both National Scholars, from the Frome School), damascened salver; 602, the same, lamps, &c.; 628, the same, lecterns, lamps, &c.; 567, W. Letheren, sen. (Cheltenham), wrought-iron grille; 563, W. P. Hodgkinson (Coventry), iron flower-stand; 569, H. Faulks (Birmingham), wrought-iron cabinet; 574, F. C. Jessop (Rotherham), grates and fenders.

SECTION VI.—*Plate and Plated Wares.*—No. 726, G. A. Carter (Lambeth, formerly Dulwich), Goodwood "Cup," subject, "Don Quixote and Sancho Panza"; 728, the same, "King John signing Magna Charta"; 743, W. F. Randall, N.S. (Stroud), design for centre-piece, tazza, &c., awarded a prize of £50 by the Goldsmiths' Company; 734, shield in repoussé silver, designed by John Watkins,* N.S. (Birmingham), and chased by Thos. Spall (Birmingham); 735, for design the same; 759, O. Gibbons, N.S. (Cirencester), plaster model of shield; 716, R. Lunn, N.S. (Sheffield), model for plateau; 715, the same, design for loving cup; 668, H. Fellows (Birmingham), claret jug.

SECTION VII.—*Jewellery and Personal Ornaments.*—No. 783, T. W. Wilson, N.S. (South Kensington), design for necklace and pendant in enamelled and jewelled gold, obtained the National Gold Medal, and a prize of £25 offered by the Goldsmiths' Company; 797A, J. J. Oxer (Lambeth), designs for crosses, pendants, lockets, &c.; 769, G. A. Carter (Lambeth), gold belt, subject, "The Months."

SECTION VIII.—*Furniture, Wood-carving, &c.*—Nos. 858, 878, 883, and 893, W. F. Randall, N.S. (Stroud), chimney corner, cabinet, chimney-piece, bookcases, &c.; 803, R. Pinches (Chester), wood mosaic; 827 and 828, Miss M. E. Reeks and Miss H. E. Wahab (Royal Albert Hall School of Wood-Carving), two pairs of bellows copied from examples in the South Kensington Museum; 834, H. L. Montford (same school), architectural moulding; 800, W. Allwright (West London), carved sideboard; 824, Students of Royal Albert Hall School of Wood-Carving, copy of carved mantelpiece; 851, J. J. Clow (Exeter and Barnstaple), panels; 891, Miss Edith Rogers (Westminster and Lambeth), design for inlaid box; 895, W. S. Watson (South Kensington), design for panel; 781, Geo. T. Morgan, N.S. (Birmingham), medals.

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* Mr. Watkins is one of those who, failing to find remunerative employment at home, has met with greater appreciation in Paris, his adopted home, where his eminence as a designer is generally acknowledged. In other parts of the gallery may be seen his drawings of the courts and galleries of the South Kensington Museum (1393), and some of his designs for the title-pages of books (1356 and 1357).

SECTION IX.—*Decorative Carvings in Stone or Marble.*—No. 948, Henry Bates (Technical Branch of the Lambeth School), classical sculpture in low relief, obtained the Royal Academy Gold Medal and Travelling Studentship of £200; 946, W. F. Frith (Lambeth), "Boadicea," won the first prize of £250 in the competition for a group of statuary for one of the piers of Blackfriars Bridge; 945, the same, design for tomb, with recumbent effigy of the late Archbishop of Canterbury.

SECTION X.—*Lace.*—No. 958, T. W. Hammond (Nottingham), curtains; 965, T. Meldrum (Nottingham), design for curtains; 966, Miss M. Joyce (Dover), designs for Honiton point lace; 975, T. F. Travell (Nottingham), design for curtain; 976, W. J. Spooner (Nottingham), design for curtain; 981, A. J. Sewell (Nottingham), design for curtain; 989, Miss Blanche Story (Nottingham), design for curtain; 997, G. Stafford (Nottingham), design for curtain; 999, J. M. Carr (Nottingham), design for curtain; 1002, Miss Jessie Hallam, now Mrs. Hubball (Exeter), design for cape; 1006 and 1014, the same, designs for flouncing; 1018, J. G. Mackenzie, N.S. (Belfast), design for curtain; 1038 to 1043, A. Foster (Nottingham), specimens of lace edging.

SECTION XI.—*Woven Damasks.*—No. 1049, J. Ward, N.S. (Belfast), table-cloth.

SECTION XII.—*Silks, Ribbons, &c.*—No. 1113, J. Booth (Macclesfield), design for embroidered table-cover; 1076, J. O. Nicholson (Macclesfield), furniture silks; 1100, Jos. Kavanagh (Dublin), silk poplins; 1066 and 1071, J. J. Black (Manchester), brocaded satin damask; 1051 to 1060, W. Folliott (Spitalfields), silk hangings; 1104, W. J. Clulow (Macclesfield), design for silk damask; 1107, H. Riseley (Macclesfield), design for furniture silk; 1112, T. J. Donahue (Macclesfield), design for embroidered silk cover; 1115, J. Q. Lane, N.S. (Belfast), design for damask table-cover. Macclesfield has an important share in the merits of this Section, and some good work is sent from its Embroidery School, including No. 1118, embroidered bed-quilts, designed by Jas. Hoggins (Coventry and Macclesfield), the colouring by J. O. Nicholson.

SECTION XV.—*Carpets and Woven Tapestry.*—Nos. 1180 and 1189, J. J. Black (Manchester), and 1184, J. W. Riley (Halifax), tapestry hangings; 1193, J. Alexander (Manchester), carpet pattern; 1197, W. Tannahill (Kilmarnock), muslin crete curtain; 1176, H. Robinson (Halifax), pattern of Brussels carpet; 1202, W. A. Lawson (Glasgow), Oriental reversible curtains of "Noil" silk; 1221, G. M. Fidler (Salisbury), design for carpet; 1239, J. J. Brownsword (Derby Central School), design for Wilton carpet.

SECTION XVI.—*Painted Decorations, Wall Papers, &c.*—No. 1283, E. J. Poynter, R.A. (Somerset House), "Martyrdom of St. Stephen," design for fresco decoration of the chancel of St. Stephen's Church, Sydenham Hill; 1285, the same, decoration for the soffit of the arch of the Lecture Theatre, South Kensington Museum; 1284, the same, "The Months," executed in tiles for the grill-room of the South

Kensington Museum; 1311, H. W. Ellis (Cambridge), A. Silver (Reading), and O. W. Davis (West London), wall papers; 1315, Miss Frances Brett (Dublin), design for wall paper; 1320, T. W. Hay (Edinburgh), wall paper.

SECTION XVII.—*Lithographs, Chromo-lithographs, &c.*—No. 1338, W. J. Muckley (Manchester), Christmas and other cards; 1341, Miss M. A. Lewis (Lambeth), Christmas and other cards; 1344, chromo-lithograph of a Chinese vase in cloisonné enamel, Geo. Moore (Manchester).

SECTION XVIII.—*Title-pages, &c.*—No. 1357, J. Watkins, N.S. (Birmingham), ornamental borders, title-pages, &c.

SECTION XIX.—*Etchings, Engravings on Wood, and Drawings for Engravings.*—Nos. 1384 and 1387, C. P. Slocombe (Spitalfields and Somerset House), etchings; 1386, 1391, and 1392, F. A. Slocombe, N.S. (South Kensington), etchings; 1396 and 1397, C. O. Murray (Edinburgh), etchings; 1359 and 1360, Chas. Roberts (Lambeth and South Kensington), wood engravings; 1383, T. W. Wilson, N.S. (South Kensington), sketches executed by various processes; 1365 and 1378, Herbert Johnson (St. Martin's, Long Acre), drawings for illustrated papers; 1373, D. Knowles (West London), and 1377, W. S. Black (Edinburgh), drawings in black and white.

SECTION XX.—*Painted Photographs of Objects of Decorative Art.*—No. 1408, J. I. Williamson (South Kensington), gold embroidered and jewelled letter-case; 1409, the same, gold enamelled and jewelled scent-bottle and stand; 1416, the same, buhl table, from the Jones collection; 1432, Miss Harriet Skidmore (Stourbridge and South Kensington), Flemish tapestry, from St. Mary's Hall, Coventry; 1418, J. Randall (South Kensington), Byzantine shrine or reliquary; 1419, the same, triptych of gilt metal; 1436, Miss Rosa Wallis (South Kensington), under-cover of a Book of the Gospels. The whole of the work in this section is very meritorious.

SECTION XXI.—*Architectural Drawings and Designs.*—Nos. 1441, 1442, 1443, and 1444, exterior and interior views of the Church of the Oratory, now in course of completion at South Kensington, designed by Herbert A. Gribble (South Kensington); 1449, F. W. Woodhouse (South Kensington), student's design; 1450, W. P. Watson (South Kensington), east door of St. Paul's Cathedral.

SECTION XXII.—*Miscellaneous.*—No. 1355, the late Godfrey Sykes (Sheffield), ornamental alphabet.

In making selections here and there from a collection which includes some fifteen hundred entries, the object has been, not to make invidious distinction where there is so much that is meritorious, but simply to point to a few examples in each department. It would be easy to multiply the number, and it is hoped that visitors to the

International Health Exhibition will give special attention to one of its most admirable and most interesting sections.

On the merits of this display, on the general concurrence of testimony as to the good work already accomplished, on the fair promise of still more important results in the future, on the broad ground of public policy, the Schools of Art confidently base their claims to increased national support, convinced that they have fairly earned the favour of the Legislature and the sympathy of the public. Whatever may be said as to the methods by which it has been attained, there is no doubt as to their great practical usefulness, and the experience of the past justifies the most hopeful aspirations for the future. The work in which the schools are so successfully engaged deserves the hearty co-operation of all sections of the community, and cannot fail in its continued and increased influence on the industrial arts, if it be but pursued in the spirit that animates the noble words of one who has distinguished himself by the graces of his speech no less than by the graces of his pencil—the present President of the Royal Academy—words which should be taken to heart, not only by students and teachers, but by all to whom they look for countenance and encouragement :—

"Believe me, whatever of dignity, whatever of strength, we have within us will dignify and make strong the labours of our hands; whatever littleness degrades our spirit will lessen them and drag them down. Whatever noble fire is in our hearts will burn also in our work, whatever purity is ours will chasten and exalt it; for as we are, so our work is, and what we sow in our lives, that, beyond a doubt, we shall reap for good or for ill in the strengthening or defacing of whatever gifts have fallen to our lot."

COLOUR.

Elementary.

Class 2.—Grisaille in Figure and oil,
hand). Cast.
Class 1.—Flowers
Constr ure, alter-
namen ith well-
examples
Painting
lasters or
competent

Copying
es and
g others
styles.

Advanced.

Class 3. — Still-life composition from real objects of art, selected with reference to decorative purposes.

Class 2. — Painting the Figure in Grisaille from the Cast, alternately with study from the Living Model.

Class 1. — Painting Ornamental and Decorative designs, composed immediately from
bjects, as Flowers, Fruit, Shells,
&c., with the introduction of the
Figure and other examples of
ife, selected as suitable for the
of decoration. The practice of
nd Encaustic, and also the har-
combination of Colours in Designs
facturers.

MODELLING.

Elementary.

Class 2.—Modelling from the Ornamental Cast.

Class 1.—Modelling from Shaded Drawings.

Advanced.

Class 4.—Modelling Ornament from mere outlines, thus practising the student to give his own inflection to the forms.

Class 3.—Modelling the Figure from the Cast according to the progress of the student in Drawing.

Class 2.—Modelling from Nature, Figure as well as Flowers, Fruits, &c., according to the progress of the student in Drawing.

Class 1.—Modelling compositions from Nature, similar to Class 1 (*Advanced Painting*), also the composition of Vases, Candelabra, Friezes, &c.

DESIGN.

Class 4.—eneral Class for the Study of the principles of Design, to be formed of the above
for the ith the exception of the Elementary Class for Modelling), together with such a
produc of Students from all the other advanced classes as may appear desirable to the
Class Lecturer, or Master. The course to consist of an analysis of the principles of
the b onstruction as observable in animal and floral life, together with demonstrations of
ples of ve principles of Ornament found in the styles of every age, clime, and country,
trated ese through to modern adaptations of antique forms. The Class to assemble once
ation n each week; the demonstrations of one lecture to form the subject of exercise
Design ext. Every Student to make an attempt to give his own idea of the principle
d by producing a design adapted as far as possible to the purposes of his own
ure. Every drawing so produced to be analysed by the Lecturer in the presence
hole Class, and its errors pointed out in a kindly and encouraging spirit. A
examination of the whole to take place, the Class being then divided into
according to the pursuits of the students, a subject being then given for each
o work out under the immediate superintendence of the examiners appointed by
r authorities.

MANUFACTURE.

Class 1.— this head would necessarily vary with each Manufacture, and means should be
period n of the advanced and senior pupils in the leading principles of that in which
work ters employed in the General Course could not be expected to understand the
by the ufacture, an inducement might be held out, in the shape of a professorship or
Class 2.— als connected with the staple trades of certain localities, to instruct the Students
of the o be known before a successful design can be produced, except by chance, for
Class 3.— oubtlessly be required for the full development of this section, but it cannot be
thus nction and fair remuneration followed the labours of such individuals as those
gies would be excited, and their qualifications soon equal the requirements of each
vn for conducting such classes, inasmuch as each Professor or Teacher would adopt
he wants of the manufacture in which it would be his duty to instruct his pupils.

GEORGE WALLIS.

V

To follow page 860.

APPENDIX B.

SUGGESTIONS FOR THE MANAGEMENT OF THE SCHOOL OF DESIGN.

PREPARED BY SIR HENRY COLE, AND PLACED BY HIM BEFORE THE SELECT COMMITTEE ON THE SCHOOL OF DESIGN, MAY 1849.

To cause the School of Design to realise its object, namely, the practical improvement in design for ornamental manufactures; to obtain all the advantages possible from the copyright registration of ornamental designs, intimately connected with their improvement as it is; to secure and conduct a systematic exhibition of decorative manufactures in London and the provincial towns, which shall show periodically what progress has been made and is making; and to extend elementary teaching of drawing in connection with the school; all appear to me to necessitate the appointment of a special agency, charged to superintend the whole subject.

In constituting such an agency, it appears indispensable, both for the sake of due economy and to ensure an efficient administration—

1st. To have the members of the executive as few as possible, and properly paid.

2nd. To make the performance of the duties the primary consideration of all parties charged with them, and to define them as precisely as possible.

3rd. To make the responsibility definite and individual.

4th. To bring all the results of the management systematically to the test of public opinion.

The duties of the Design Department would be of two kinds, lay and artistic; both should come under the general charge of the Head of the Department, who might appropriately be either the President or Vice-President of the Board of Trade for the time being; but not both or one or the other interchangeably.

The duties of the Head of the Department would be to control and sanction all proceedings; to make all appointments and dismissals; to judge of all results, and to communicate personally with Parliament and the Government.

To provide for an efficient Lay Management there would be required; 1st. an acting Deputy of the President; 2nd. a Secretary, who might also be Accountant; and 3rd. a Curator of the Collections, who might also be General Lecturer.

The duties of the Deputy would be, as respects—

1.—Finances.—To see after the proper apportionment of the funds to each object; the proper and systematic encouragement of voluntary subscriptions; to originate all expenditure, according to fixed rules, and to see to the proper audit of accounts.

2.—Establishment of Elementary and Branch Schools.—To examine and decide questions on this subject; to ascertain where schools are most wanted; to encourage their establishment by voluntary associations; to communicate with the local committees, mechanics' institutes, national schools, &c.

3.—Connection of Design with Manufactures.—To be responsible for bringing manufacturers into direct communication with the school and students, and for finding out their wants and for making the working of the school so practical as to supply them.

4.—The Superintendence of the Organisation of Lay Details connected with the Schools, and the proper administration of them.—To see to the proper arrangement and obtaining of casts, examples, specimens of manufactures, the proper making of catalogues, collections of books, publications necessary, such as handbooks, &c.

5.—Superintendence and Organisation of Exhibitions of Works of the School and of Manufactures, both in London and the country.

6.—To prepare annual reports to Parliament under the sanction of the President, which would consist of a digest of the reports of the masters of the local committees, and of the state and progress of the registration of designs.

7.—To extend the operations of the School generally.

The duties of the Secretary and Accountant would be,—To conduct and register all correspondence; to keep proper accounts and pay bills; to methodise returns of attendance of students; to have charge of all official papers; to attend meetings of masters, &c.; to prepare returns, papers, &c.

The duties of the Curator of Collections and Library, and General Lecturer, would be to see to the proper management and care of the collections in London and in the country; to the revision of catalogues from time to time; to deliver certain lectures; to attend to the library, &c.

Educational Management.—Elementary teaching, and specific design applicable to manufactures.

Head Masters of the School, who should be artists of eminent ability, acquainted with manufactures.

All the masters should be charged with the superintendence of the elementary instruction and of art-workmanship, such as putting on patterns, engraving, modelling, chasing, die-sinking, &c.; and each master with the duty of looking after original design for some specific classes of manufactures, which might perhaps be divided as follows:

(*a*) Design applicable to woven fabrics where the decoration is printed or stamped, as in calicoes, mousselines-de-laine, &c.

(*b*) Design applicable to fabrics where the decoration is woven, as in silks, shawls, ribbons, carpets, &c.

(*c*) Design applicable to surface decoration, such as decoration of walls, paper-hangings, papier mâché, &c.

(*d*) Design applicable to metal work, as gold, silver, iron, brass, &c.

(*e*) Design applicable to pottery, glass, wood, ivory, gutta percha, &c.

The Head Masters should be charged with the whole management and responsibility of the instruction of the schools in London and in the country; with the inspection of the country schools, the whole being parcelled into districts whose manufactures approximate in generic character (*e.g.* Birmingham and Sheffield, the Potteries and Stourbridge, Kidderminster and Coventry, Manchester and Glasgow, &c.). They should be charged with the nomination of the assistant and country masters, to be appointed by the President; with the nomination of the exhibitioners, of whom certain should be selected from the country schools.

They should be obliged to report annually on the progress of the schools both in London and the country, and on the general progress of ornamental design, each in his own department. They should be obliged to make, or cause to be made, a certain number of designs for the manufactures they superintend, which should be exhibited in the annual exhibition.

They should be obliged to lecture occasionally on specific subjects, both in London and at their visit of inspection to the country schools.

They should draw up regulations for the management of the instruction in London and the country, in respect both of the precise duties of the Assistant Masters, and of the principles of instruction which ought to be adopted.

The Assistant Masters in town and country should be directly responsible to the Head Masters, and obliged to produce designs for manufactures. The Assistants in the country would have to make reports to the Head Masters.

The Female School in London should be under the superintendence of the Head Masters.

APPENDIX C.—EXISTING SCHOOLS OF ART, METROPOLITAN AND PROVINCIAL, WITH DATE OF ESTABLISHMENT.

**** The Branches are of a later date than the Schools of which they are offshoots.*

1842.
- Birmingham (with 6 branches).
- Manchester (Cavendish St.).
- Bloomsbury (Female).
- York (Minster Yard).

1843.
- Nottingham.
- Sheffield.

1844.
- Coventry.
- Glasgow (with 5 branches).
- Newcastle-on-Tyne (Library Place).

1846.
- Norwich.

1847.
- Hanley.
- Leeds.
- Stoke-on-Trent.

1849.
- Dublin.

1851.
- Macclesfield.
- Worcester.

1852.
- Limerick.
- Stourbridge.

1853.
- Aberdeen.
- Bristol.
- Carnarvon.
- Cheltenham.
- Chester.
- Dudley.
- Durham.
- St. Thomas', Charterhouse.
- Newcastle-under-Lyme.
- Penzance.
- Swansea.
- Truro.
- Warrington.

1854.
- Andover.
- Bath.
- Carlisle.
- Carmarthen.*
- Cork.
- Exeter.
- Lambeth (with 1 branch).
- St. Martin's, Long Acre.
- South Kensington.
- Tavistock.†
- Wolverhampton.

1855.
- Birkenhead (Park entrance).
- Liverpool (S. D.st., Mount St.).
- Liverpool (N. Dist. Liverpool College).‡
- Shrewsbury.
- Southampton (Hartley Inst.).

1856.
- Coalbrookdale (with 1 branch).
- Dundee (High School).
- Lancaster.
- Taunton.

1857.
- Darlington (with 1 branch).
- Stirling.
- Great Yarmouth.

1858.
- Brighton (with 1 branch).
- Cambridge.
- Edinburgh (Male).
- Edinburgh (Female).
- Ipswich.

1859.
- Gloucester.
- Halifax.

1860.
- Boston.
- Bromsgrove.
- Cirencester.
- Preston.
- Reading.
- Stroud.

1861.
- Hull.
- Warminster.

1862.
- Kidderminster.
- West London.

1863.
- Lincoln.
- Perth.

1864.
- Devizes.
- Trowbridge.

1865.
- Bridport.
- Frome.
- Inverness.
- Oxford.
- Salisbury.

1867.
- Dorchester.
- Kilmarnock.

1868.
- Cardiff.
- Croydon.
- Lewes.
- North London (Kingsland).
- Wakefield.

1869.
- Burslem.
- Manchester (Gram. School).
- Sunderland.

1870.
- Belfast.
- Derby.
- Dover.
- Keighley.
- Kendal.
- Leamington.
- Leicester (Hastings Street).
- Portsmouth.
- Winchester.

1871.
- Bradford (Mech. Inst.).
- Northampton.
- Ryde.
- Shipley.
- Walsal.

1872.
- Farnham.
- Huddersfield.
- Stratford.
- Redditch.
- Selby.
- Southampton (Philharmonic Hall).

1873.
- Berwick-on-Tweed.
- Islington.
- Middlesborough.

1874.
- Barnsley.
- Barrow-in-Furness.
- Bradford (Gram. School).
- Bradford (Church Inst.).
- Dumfries.
- Hartlepool (West).

1874 (*contd.*)
- Rotherham.
- Stafford.
- Watford.

1875.
- Bideford.
- Devonport.
- Dollar.
- Hastings & St. Leonards.
- Londonderry.
- Newport (Mon.).

1876.
- Bolton.
- Elgin.
- Mansfield.
- Plymouth (9, York Street).
- Westminster (Royal Arch. Museum).

1877.
- Barnstaple.
- Doncaster.
- Weymouth.

1878.
- Bromley (Kent).
- Falkirk.
- Manchester (Longsight Mech Inst.).
- Morpeth.
- Newcastle-on-Tyne (Corporation Street).

1879.
- Burnley.
- Chesterfield.
- Liskeard.
- Plymouth (Y. M. Christian Association).
- Sleaford.
- Torquay.

1880.
- Gosport.
- Leicester Wyggeston's Hospital).
- Manchester (Mech. Inst.).
- Blackheath, Lee, & Lewisham.
- Blackheath Hill.
- Newcastle-on-Tyne (Mech. Inst., New Bridge St.)
- Poole.
- York (Inst., Low Ousegate).

1881.
- Bedford.
- Bournemouth.
- Burton-on-Trent.
- Hertford.
- Ilkley.
- Chiswick.
- St. Alban's.
- South Shields.
- Waterford.

1882.
- Lowestoft.
- Canterbury.
- Chelsea.
- Dundee (Strathmore Hall).
- Hornsey.
- Peterborough.
- Scarborough.
- Stoke Newington.
- Tiverton.
- Weston-super-Mare.

1883.
- Birkenhead (The Holt, Tranmere).
- Bradford (Tech. College).
- Holloway (Camden School).

Schools of Art have also been established in India, at Lahore, Bombay, Calcutta, Madras, and Jeypore; and in Australia, at Sydney and Adelaide. These Schools are not in connection with South Kensington, but most of the masters have been trained there.

* Re-established 1880. † Re-opened 1866. ‡ Re-opened 1872.

APPENDIX D.

TABLE SHOWING THE NUMBER OF PERSONS RECEIVING INSTRUCTION IN ART, OR IN ELEMENTARY DRAWING, IN THE YEARS 1857 TO 1883, FROM TEACHERS HOLDING DRAWING CERTIFICATES GRANTED BY THE SCIENCE AND ART DEPARTMENT.

Years.	1. Elementary Day Schools.	2. Training Colleges for Elementary School Teachers.*	3. Art Classes.	4. Provincial and Metropolitan Schools of Art, including the National Art Training School at South Kensington.	5. Art Teachers in Training and National Scholars at South Kensington.	6. Grammar Schools and other Schools examined but not aided by Grants.†	7. Teachers and Pupil Teachers. ‡	Totals.
1857	30,802	..	..	11,016	71	..	1,323	43,212
1858	65,465	..	..	11,931	62	..	2,012	79,470
1859	67,490	..	..	15,096	64	..	2,322	84,972
1860	74,267	..	..	12,651	68	..	2,495	89,481
1861	76,303	..	..	13,360	50	..	2,123	91,836
1862	71,423	..	..	13,863	59	..	2,044	87,389
1863	79,845	..	..	15,019	52	..	1,461	96,377
1864	94,083	..	..	15,527	42	..	1,028	110,680
1865	86,967	..	..	15,702	39	..	919	103,627
1866	80,084	..	1,140	18,139	47	4,219	1,049	104,668
1867	79,411	..	2,553	17,341	44	4,529	1,651	105,529
1868	93,713	2,035	4,571	18,474	53	4,716	..	123,562
1869	120,928	2,101	9,322	19,864	41	4,951	..	157,207
1870	147,243	2,418	12,119	20,290	59	5,787	..	187,916
1871	166,456	2,676	16,140	21,155	62	6,012	..	212,501
1872	194,549	3,105	17,256	22,854	61	6,309	..	244,134
1873	237,733	3,419	20,352	23,368	56	5,248	..	290,176
1874	290,425	3,475	21,851	24,138	59	5,434	..	345,382
1875	387,640	3,653	25,359	26,538	59	6,440	..	449,689
1876	460,961	3,685	31,158	27,973	52	6,583	..	530,412
1877	541,039	3,714	29,579	29,414	55	6,819	..	610,620
1878	660,531	3,775	27,152	29,415	52	6,949	..	727,874
1879	725,129	3,698	29,393	29,191	52	7,981	..	795,444
1880	768,661	3,568	26,646	30,239	54	8,140	..	837,308
1881	850,563	3,501	23,026	31,592	49	8,370	..	917,101
1882	842,100	3,454	21,215	33,729	55	8,663	..	909,216
1883	767,194	3,476	26,424	35,909	51	6,891	..	843,135

* Students in these Colleges were examined in 1867 and previous years, but payments in aid of their instruction were first made under the regulations of the Science and Art Department in 1868.

† Previous to 1866, included under head No. 1,

‡ Since 1868, Teachers and Pupil-Teachers have been instructed in Schools of Art, Art Classes, and Elementary Day Schools, and are included in the numbers given under those heads.

APPENDIX E.

TABLE SHOWING THE TOTAL AMOUNTS OF THE FEES PAID BY THE STUDENTS, OF THE LOCAL SUBSCRIPTIONS, OF THE INCOME OF THE SCHOOLS, AND OF THE AID GRANTED TO SCHOOLS OF ART BY THE DEPARTMENT, IN THE YEARS 1866 TO 1883, EXCLUSIVE OF THE COST OF CIRCULATION OF LOANS OF ART OBJECTS, BOOKS, PICTURES, ETC.

Years.	Fees Paid.				Amount of Subscriptions, &c., received.	Total Income of Schools, including Payments on Results.	Payments by Department on Results, Building Grants, &c.†	Aid towards Purchase of Examples and Fittings.	Cost of Prizes.	Total Aid by Department.
	By Private Schools.	Schools of Art. By Morning Classes.	Schools of Art. By Evening Classes.	Total Fees.						
	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.
1866	2,492	9,878	6,302	18,672 *	Not reported separately previous to 1876.	26,638	4,112	Not reported separately previous to 1876.	1,546	5,659
1867	2,152	8,505	7,145	17,803		26,995	4,759		1,034	5,794
1868	1,547	10,616	6 352	18,515		31,956	9,725		1,683	11,408
1869	1,452	12,097	6,650	20,200		34,144	9,829		1,513	11,343
1870	1,798	12,843	6,825	21,468		37,878	10,383		2,023	12,406
1871	1,904	14,026	7,501	23,432		40,345	10,706		2,394	13,100
1872	2,115	14,639	7,929	24,836		42,753	11,501		2,638	14,140
1873	1,868	15,143	8,915	26,392		44,669	13,593		2,584	16,177
1874	2,037	16,054	9,033	27,213		44,968	12,617		2,464	15,082
1875	1,719	18,328	9,720	30,338		49,446	14,541		2,658	17,200
1876	1,816	20,872	10,658	33,348	6,565	55,748	15,834	639	1,779	18,253
1877	1,490	22,821	11,034	35,346	6,376	56,695	14,972	1,050	1,476	17,500
1878	1,439	22,882	10,292	34,630	6,783	56,256	14,859	1,016	1,891	17,767
1879	1,526	23,099	10,401	35,027	6,515	56,691	15,207	514	1,795	17,517
1880	1,826	24,069	10,570	36,467	8,387	61,945	17,091	454	2,865	20,410
1881	1,118	24,105	10,229	35,452	8,405	60,273	16,415	613	2,453	19,482
1882	1,014	26,609	11,575	39,198	7,998	64,175	16,978	742	2,472	20,193
1883	..	..	..	38,594	‡	‡	19,243	..	..	26,376

* In 1866 new Minutes came into force, under which aid was given to Schools for the Poor by payments made direct to the managers of such Schools, and the fees paid by them for instruction for the most part ceased to be returned as part of the income of Schools of Art, although many of the Schools for the Poor were still instructed by teachers who also taught in Schools of Art.

† The Building Grants (1861–84) have been 40 in number, ranging from £157 to £750, and amounting in the aggregate to £14,436 11*s*.

‡ The above statistics being tabulated this year in a new form, the amount of subscriptions, &c., received in 1883 can only be given approximately at about £8,000. This would make the total income of the Schools, including payments on results, £65,837.

APPENDIX F.

LIST OF STUDENTS OF THE TRAINING CLASS AT SOUTH KENSINGTON, PAST AND PRESENT.

*** *The third column shows the Schools of Art whence the students were received; the word "Unconnected" indicates that the previous training was unconnected with the Department. Where blanks are found in the fourth column the employment (if any) was unconnected with the Department. The period of training was in some cases interrupted by temporary appointments.*

Name.	Period.	Educated at	Appointed to
Addey, Joseph P.	1872 to 1875	Cork	Londonderry.
Allan, James B.	1853 to 1856	Metropolitan	
Anderson, David	1876 to 1881	Dundee	Glasgow.
Anderson, John	1858 to 1863	Stoke	Halifax, Coventry.
Anderson, Henry T.	1853 to 1863	Metropolitan	Birmingham, Truro.
Andrew, Frederick W.	1855	Metropolitan	Employed by Department.
Arthur, Thomas	1853 to 1857	Metropolitan	
Ashworth, Susan A.	1854 to 1858	Metropolitan	Dublin, Edinburgh.
Atkinson, George M.	1855 to 1859	Cork	Birmingham.
Ayres, Helena	1869 to 1872	Bristol	
Bacon, Joseph P.	1854 to 1856	Manchester	Stoke-on-Trent and Newcastle-under-Lyme.
Baines, Catherine	1855 to 1859	Metropolitan	
Baker, Leonard	1853 to 1856	Metropolitan	Dunfermline, Stirling.
Baker, Thomas	1869 to 1873	Coventry	Bridport, Weymouth.
Baker, Wm. John	1853 to 1855	Unconnected	Southampton.
Baldry, Alfred L.	1878 to 1879	S. Kensington	
Bale, Edwin	1855 to 1863	Metropolitan	Lambeth.
Banner, Alexander	1857 to 1861	Liverpool	Glasgow.
Barkas, Henry D.	1878 to 1880	Bath	Bradford (Church Inst.).
Barry, Sarah	1868 to 1871	Cork	
Barton, William B.	1878 to 1882	Leicester	Preston.
Bate, Henry F.	1878 to 1879	S. Kensington	
Bebb, Isabel L.	1880 to 1883	Bath	
Belinaye, Laura de la	1854 to 1857	Metropolitan	Bloomsbury, Queen Square.
Bentley, John	1854 to 1861	Macclesfield	Swansea, Toronto, Birkenhead.
Birkmeyer, Jas. B.	1857 to 1861	Liverpool	Exeter.
Birtles, Thomas	1857 to 1858	Warrington	
Black, Amy Eliza	1863 to 1868	Metropolitan	Employed by Department.
Black, Francis	1878 to 1882	Nottingham	Charterhouse.
Blair, David	1870 to 1872	Birkenhead	
Blizard, Edward	1855 to 1860	Metropolitan	Birmingham.
Boon, William	1860 to 1865	Hanley	Canterbury.
Bowen, William P.	1853 to 1854	Worcester	Worcester.
Bradbury, Alfred	1865 to 1870	Leeds	Hanley.
Brenan, James	1855 to 1860	Dublin	Birmingham, Yarmouth, Cork.
Broad, Sophia	1877 to 1879	Metropolitan	
Broad, William	1870 to 1875	Tavistock	Stroud.
Brook, Alfred N.	1853 to 1859	Man hester	Glasgow, Carlisle, Cheltenham.

Name.	Period.	Educated at	Appointed to
Broom, Edward	1856 to 1857	Metropolitan	
Brophy, Nich. A.	1857 to 1859	Dublin	Limerick.
Brophy, Patrick	1856 to 1866	Dublin	Yarmouth.
Brown, Frederick	1871 to 1877	Metropolitan	Westminster, Royal Arch. Museum.
Bunker, Joseph	1869 to 1873	Oxford	Stroud, Wakefield.
Burkinshaw, S.	1853 to 1855	Birmingham	Liverpool.
Busk, William	1881 to	Metropolitan	Still in training.
Bustin, R. B.	1853 to 1854	Metropolitan	Hereford.
Cahill, Richard S.	1854 to 1858	Unconnected	Dunfermline.
Cameron, Duncan	1858 to 1859	Dundee	
Campbell, John A.	1859 to 1865	Metropolitan	
Carter, Grace	1872 to 1874	S. Kensington	Boston, U.S.A.
Carter, James	1856 to 1861	Metropolitan	Burnley, Hanley, Portsmouth.
Carter, Mary	1872 to 1873	S. Kensington	Boston, U.S.A.
Cartlidge, S. J.	1874 to 1881	Burslem	Hanley.
Casey, William L.	1853 to 1855	Cork	Limerick, Lambeth.
Caston, Alice	1882 to 1884	Metropolitan	
Catley, William	1867 to 1872	Boston	Preston.
Chandler, Edwin	1858 to 1864	Plymouth	Hull.
Channon, Mary E.	1855 to 1857	Metropolitan	South Kensington.
Charbonnier, Theo.	1868 to 1874	Bristol	Ryde, Southampton.
Chevallier, Tho. W.	1853 to 1857	Metropolitan	Tavistock, Yarmouth.
Childe, Ellen Eliza	1866 to 1868	Metropolitan	Philadelphia.
Clack, Thomas	1854 to 1861	Coventry	Limerick, Charterhouse, S. Kensington Museum, National Art T. School.
Clark, Charles Macdonald	1855 to 1859	Manchester	South Kensington.
Clarke, James	1878 to 1880	Metropolitan	
Cochrane, Robert	1853 to 1860	Unconnected	Dudley, Norwich.
Cole, Archibald	1853 to 1855	Unconnected	York, Madras.
Cole, Thomas W.	1882 to 1884	Metropolitan	South Kensington.
Collier, Bernard C.	1875 to 1880	Metropolitan	York, Canterbury.
Collier, Thomas F.	1852 to 1855	Dublin	Cork, Marlborough House.
Collins, Emma	1861 to 1866	Metropolitan	Freemason's School, Clapham.
Collins, Florence	1854 to 1855	Metropolitan	South Kensington.
Collinson, Robert	1853 to 1855	Manchester	Warrington, Marlborough House.
Cortissos, Charles	1869 to 1874	Rotherhithe	Shrewsbury.
Cosbie, William S.	1856 to 1860	Liverpool	Bristol.
Cotchett, Thomas	1854 to 1856	Metropolitan	
Cox, William	1867 to 1869	Metropolitan	Sheffield, Ryde.
Craigmile, Wm.	1883 to	Hull	Still in training.
Craister, Walter	1865 to 1867	York	Chester.
Croasdale, Elizabeth	1868 to 1869	Metropolitan	South America.
Croome, John D.	1852 to 1856	Unconnected	Waterford, Belfast.
Dalgleish, T. J.	1874 to 1880	Coventry	Nottingham.
Davies, James	1853 to 1860	Metropolitan	Carmarthen, Bridgewater.

Name.	Period.	Educated at	Appointed to
Dickenson, Henry D.	1867 to 1872	Newcastle-on-Tyne	Bromsgrove and Redditch.
Dodd, Charles T.	1882 to	Metropolitan	Still in training.
Doidge, Sarah	1854 to 1859	Metropolitan	District Schools, London.
Dominy, John	1860 to 1865	Devonport	Yarmouth.
Drummond, John G.	1852 to 1857	Cork	Llanelly, Bath.
Duckett, Wm.	1864 to 1870	Preston	Dover.
Duncan, Wm.	1861 to 1863	Unconnected	Stafford.
Dundas, James	1860 to 1864	Dundee	Greenwich Hospital Schl.
Dunlop, James M.	1882 to	Kilmarnock	Still in training.
Earles, Fredk. R.	1881 to	Metropolitan	Still in training.
East, W. H.	1873 to 1877	Metropolitan	Dover.
Edgley, Sarah Jane	1855 to 1860	Metropolitan	
Edwards, John	1857 to 1858	Dunfermline	Stirling.
Edwards, Maria	1858 to 1864	Metropolitan	Employed by Owen Jones.
Elgood, Geo. S.	1872 to 1874	Leicester	
Elliott, Rebecca	1857 to 1862	Metropolitan	
Elton, Edgar	1879 to	Metropolitan	Still in training.
Elton, Samuel	1853 to 1857	Metropolitan	Norwich, Darlington.
Farncombe, Henry	1876 to 1881	Brighton	Rose Hill Training College.
Finney, John	1853 to 1855	Newcastle	Liverpool.
Fish, Evelyn	1874 to 1875	Metropolitan	
Fisher, Amy	1879 to 1882	Metropolitan	
Fisher, Alexander	1862 to 1868	Dudley	Lewes.
Ford, James	1856 to 1861	Penzance	Leeds, Macclesfield, Cape of Good Hope.
Ford, William	1855 to 1857	Spitalfields	
Foster, William	1854 to 1855	Manchester	Birkenhead.
Fraser, A. Edward	1856 to 1860	Dublin	Clonmel.
Fraser, John P.	1861 to 1867	Aberdeen	Salisbury.
Freed, Mary A.	1855 to 1861	Metropolitan	
Fussell, Arthur	1858 to 1859	St. Martin's	
Gallimore, Samuel	1856 to 1860	Potteries	
Gear, Arth. Handel	1871 to 1874	Metropolitan	
Geddes, William	1858 to 1859	Glasgow	
Geoffroi, Fredk.	1877	Penzance	
Geoffroi, H. M.	1853	Metropolitan	Penzance, Truro.
Gibbons, Edward	1872 to 1876	Cirencester	Edinburgh.
Gibbs, Charlotte J.	1855 to 1861	Metropolitan	
Gilbert, Herbert	1853 to 1856	Metropolitan	Bath, Lancaster.
Gill, E. Rowland	1873 to 1877	Leeds	Bridport, Poole.
Gill, George R.	1853 to 1854	Unconnected	Truro.
Gill, Henry P.	1878 to 1882	Brighton	Adelaide, South Australia.
Gillow, Robert	1861 to 1863	Bath	
Girling, Richard	1853 to 1856	Unconnected	
Glass, Alexander	1858	Unconnected	
Glenny, Wm. Jos.	1859 to 1865	St. Martin's	King's College.
Godwin, Mary	1858 to 1863	Dublin Lace School	
Goepel, James S.	1862 to 1867	Liverpool	Frome.

Name.	Period.	Educated at	Appointed to
Gray, George	1855 to 1857	Potteries	
Gray, Thomas	1860 to 1863	Unconnected	West London.
Greenwood, Edwin	1876 to 1882	Kidderminster	Bombay.
Griffiths, John	1856 to 1864	Metropolitan	Employed by Department, Bombay.
Griffiths, Richard	1857 to 1860	Carnarvon	Truro.
Griffiths, William T.	1853 to 1858	Unconnected	Yarmouth, Ipswich.
Grubb, William	1867 to 1868	Dundee	Dundee (High School).
Gunn, Archibald	1855 to 1859	Unconnected	Burnley, Taunton, Wolverhampton.
Hackford, Mary	1878 to 1884	Metropolitan	
Hagreen, Henry B.	1853 to 1855	Unconnected	Marlborough House and National Art T. School.
Hale, Henry Owen	1858	Metropolitan	
Hale, Robert	1854 to 1869	Manchester	Belfast, New Cross.
Hall, Julia Georgina	1867 to 1868	Metropolitan	
Hall, Philip	1882 to	Cirencester	Still in training.
Hammond, Ellen G.	1873 to 1877	Macclesfield	Drowned on voyage to India.
Harbutt, William	1869 to 1874	Metropolitan	Bath.
Harden, Maria	1855 to 1860	Metropolitan	
Hare, George	1877 to 1884	Limerick	South Kensington.
Harley, George Wm.	1873 to 1880	Windsor	Belfast.
Harley, Robert	1855 to 1858	Unconnected	Cambridge.
Harold, Henry	1858	Finsbury	
Havell, Ernest B.	1880 to 1883	Reading	Madras.
Haydon, Edward	1861 to 1863	Warrington	
Healy, James	1853 to 1854	Dublin	Clonmel.
Heath, Alice M.	1882 to	Gloucester	Still in training.
Heazle, William	1854 to 1858	Cork	
Hewitt, Alfred E.	1883 to	Birmingham	Still in training.
Hepworth, Walter	1872 to 1873	Leicester	
Hill, Henry	1858 to 1860	Birmingham	
Hill, H.	1873 to 1875	Cardiff	Northampton.
Hill, John	1855 to 1859	Warrington	Bath.
Hill, Joseph	1872 to 1877	Hanley	Manchester.
Hill, Joseph	1858 to 1861	Metropolitan	
Hipwood, Sarah	1854 to 1858	Metropolitan	
Hodder, Albert	1870 to 1875	Bridport	Tavistock, Worcester.
Hodder, Charles D.	1854 to 1856	Metropolitan	Hanley.
Hodgetts, Thomas	1856 to 1857	Metropolitan	
Hodges, Charles M.	1871 to 1879	Bristol	Bath.
Holmes, Thomas	1854 to 1861	Dublin	Dublin, Devonport.
Home, Emily	1868 to 1871	Bristol	
Hone, Alfred	1856 to 1859	Unconnected	
Horncastle, Jane A.	1862 to 1867	Metropolitan	
Hosford, Fredk. F.	1854 to 1857	Cork	Carmarthen, Swansea.
Howard, Vernon	1855 to 1861	Metropolitan	Boston.
Hudson, Henry	1882 to	Metropolitan	Still in training.
Hulme, Fred . E.	1859 to 1864	Metropolitan	
Hulme, Robert C.	1860 to 1863	Metropolitan	Marlborough Coll., Putney, Manchester, Blackheath.
Hunt, Jane	1855 to 1858	Metropolitan	

Name.	Period.	Educated at	Appointed to
Hunter, Annie	1883 to	Metropolitan	Still in training.
Inskep, Janet	1858 to 1864	Metropolitan	
Ireland, Samuel J.	1870 to 1874	Metropolitan	Barrow-in-Furness.
Jackson, William	1854 to 1855	Unconnected	
James, Charlotte	1858 to 1860	Metropolitan	
Jefford, J. A.	1874 to 1878	Bridport	
Jewsbury, Thomas	1856 to 1857	Metropolitan	
Jobbins, Wm. Hy.	1872 to 1876	Leicester	Nottingham.
Jones, David	1862 to 1868	Carmarthen	Dudley.
Jones, William	1869 to 1874	Carmarthen	Barnsley.
Julyan, Mary	1858	Metropolitan	
Kean, J. A.	1875 to 1878	Aberdeen	Doncaster, York (Minster Yard).
Kelly, Edwin J.	1860 to 1863	Macclesfield	
Kemp, John	1854 to 1860	Cork	Gloucester.
Kemp, Minna	1875 to 1879	Metropolitan	
Kennedy, James	1861 to 1863	Dublin	
Kennedy, John	1854 to 1856	Dublin	Dundee.
Kennedy, Joseph	1858 to 1862	Dundee	Kidderminster.
Kinnebrook, Wm. A.	1853 to 1855	Unconnected	
Lamprey, Joshua	1855 to 1856	Dublin	
Lanchenick, John C.	1854 to 1862	Metropolitan	
Langman, A. W. F.	1874 to 1875	Metropolitan	Manchester Gram. School, Hartley Institute, Southampton.
Larking, Mary	1863 to 1868	Unconnected	Employed by Department.
Lee, John	1883 to	Darlington	Still in training.
Lees, Herbert	1854 to 1858	Metropolitan	Carlisle.
Legge, Lionel	1855 to 1859	Metropolitan	Lancaster, Sheffield.
Lewis, Alfred	1877 to 1882	Leicester	Weston-super-Mare.
Lindsay, Thomas	1867 to 1880	Liverpool	Belfast, Rugby College.
Llewellyn, S. H. W.	1879 to 1883	Cirencester	S. Kensington, Lambeth.
Lloyd, J. A.	1881 to 1883	Metropolitan	Marlborough College.
Lock, Henry H.	1855 to 1863	Metropolitan	St. Helen's, Westminster, Calcutta.
Longshaw, Alfd. B.	1854 to 1855	Macclesfield	
Lord, John	1855 to 1857	Dublin	Newcastle.
Lowenthal, Dora	1879 to 1882	Bristol	
Lowne, Joseph J.	1867 to 1870	Metropolitan	
Luke, Frederick	1873 to 1877	Tavistock	Dublin, Royal Society.
Lyne, Robert Edw.	1854 to 1856	Unconnected	Paisley, Glasgow.
Lyons, Thomas	1867 to 1872	Cork	Monmouth.
McCarty, William	1867 to 1870	Cork	
McCloy, Samuel	1853	Belfast	Waterford.
Macdonald, Alex.	1859 to 1864	Dundee	Oxford.

Name.	Period.	Educated at	Appointed to
McGill, Murdoch	1862 to 1868	Dudley	Cape of Good Hope.
McGregor, Sarah E.	1869 to 1872	Queen Square	
McMinn, Jane K.	1868 to 1870	Metropolitan	
McNaught, Alex.	1873 to 1876	Kilmarnock	Preston.
Marsh, Isabella	1873 to 1877	Metropolitan	
Matteaux, Clarina	1855 to 1860	Female School, Gower Street	
Menzies, John	1860 to 1866	Aberdeen	Charterhouse.
Merritt, William J.	1872 to 1880	Gloucester	Isle of Man.
Midwood, Wm. H.	1855 to 1856	Huddersfield	
Millar, Charles B.	1873 to 1877	Kilmarnock	Kilmarnock.
Millard, Charles S.	1877 to 1881	Metropolitan	Cheltenham.
Miller, Annie Dupuy	1871 to 1873	Newcastle-on Tyne	
Miller, James	1858 to 1860	Aberdeen	Cirencester.
Mills, Eliza	1854 to 1857	Female School	Whitelands Coll., Spitalfields.
Mills, Samuel F.	1858 to 1863	Metropolitan	Spitalfields.
Moffat, Frederica	1874 to 1877	Metropolitan	Technical School, Kennington
Morley, William Arthur	1855 to 1858	Metropolitan	Edinburgh.
Morrogh, John J.	1860	Cork	
Morton, George	1873 to 1878	Newcastle-on-Tyne	Assistant Master, South Kensington.
Muckley, William Jabez	1852 to 1853	Birmingham	Burslem.
Mulligan, James A.	1855 to 1856	Unconnected	Coalbrookdale.
Mulligan, Walter	1881 to	Walsall	Still in training.
Mulready, Augustus E.	1859	Metropolitan	
Murcott, Theophilus	1872 to 1877	S. Kensington	
Nesbitt, Sidney	1868 to 1869	Boston	Bath, Frome, Blackheath.
Newbery, F. H.	1882 to	Metropolitan	Still in training.
Nichols, Alfred P.	1855 to 1863	Metropolitan	Bristol.
Norris, William	1878 to 1883	Gloucester	South Kensington.
Nottingham, John Wm.	1853 to 1855	Metropolitan	
Noyes, Henry J.	1858	Unconnected	
Offord, John J.	1854 to 1856	Unconnected	Plymouth.
Park, John	1871 to 1878	Newcastle-on-Tyne	
Parker, John B.	1859 to 1867	Birmingham	Mauritius, Charterhouse, St Martin's.
Parkinson, Amelia	1871 to 1873	Metropolitan	
Payne, George	1871 to 1873	Metropolitan	
Peal, Samuel E.	1856 to 1859	Metropolitan	Finsbury.
Pearce, Joseph A.	1882 to	Bristol	Still in training.
Perkin, Emil S.	1877 to 1882	Barrow-in-Furness	Tiverton.

Name.	Period.	Educated at	Appointed to
Pilsbury, Richard	1858	Unconnected	
Pilsbury, Wilmot	1859 to 1864	Birmingham	Marylebone.
Poole, John O.	1883 to	S. Kensington	Still in training.
Pozzie, William E.	1853 to 1861	Metropolitan	Carlisle, Tavistock, Hull.
Pratt, Robert	1869	Dundee	Inverness.
Pritchard, Zachariah	1862 to 1869	Macclesfield	Manchester Gram. School.
Pryce, Henry E.	1869 to 1872	Metropolitan	
Puckett, Robert C.	1859 to 1865	Metropolitan	Brighton, Bath, St. Alban's, Watford.
Rafter, Henry	1853 to 1854	Unconnected	Coventry.
Raimbach, David	1857 to 1858	Unconnected	Birmingham.
Raimbach, Lewis	1880 to 1882	Metropolitan	
Randall, John	1855 to 1865	Metropolitan	Employed by Department.
Randerson, Pauline	1881 to	Metropolitan	Still in trianing.
Rawle, John Samuel	1858 to 1864	Unconnected	Nottingham, West London.
Rawson, William	1868 to 1874	Leeds	Keighley.
Rees, Mary	1857 to 1865	Metropolitan	
Reily, Francis	1883 to	Birmingham	Still in training.
Renard, Edwin	1878 to 1881	Hastings	Shipley.
Richards, Charles	1860 to 1861	Birmingham	
Rider, Haywood	1883 to	York	Still in training.
Riley, Benjamin	1854 to 1856	Manchester	
Riley, Thomas	1874 to 1881	Kendal	
Roberts, William	1867 to 1872	Southampton	Oxford, Stroud.
Robinson, Thos. W. H.	1867 to 1872	Leeds	Lewes.
Robjohn, Francis R.	1857 to 1861	Tavistock	Nottingham.
Rove, John	1854 to 1856	Penzance	Manchester, Taunton.
Rowland, John C.	1853	Unconnected	Carnarvon.
Ryan, Charles	1854 to 1856	Dublin	Leeds.
Ryan, Francis Jas.	1863 to 1864	Metropolitan	Great Yarmouth.
Ryder, Emily	1865 to 1867	Dublin	
Ryles, George	1856 to 1857	Potteries	Potteries, Basingstoke
Sadler, Alfred	1861 to 1863	Metropolitan	
Sawkins, Isabel	1858 to 1867	Metropolitan	
Schröder, Walter	1879 to 1884	Brighton	Chester.
Scott, Walter	1873 to 1879	Coventry	Macclesfield.
Sharpe, Herbert	1879 to 1882	Metropolitan	
Sheil, Edward	1855 to 1866	Unconnected	Cork.
Short, John T.	1859 to 1864	Bath	Andover.
Slocombe, Chas. P.	1854 to 1855	Metropolitan	South Kensington.
Smith, Isabella F.	1867 to 1871	Queen Square	
Smith, John A.	1859 to 1864	Dundee	Oxford.
Smith, Walter	1855 to 1860	Metropolitan	St. Martin's, Charterhouse, Leeds.
Smyth, Walter E.	1857 to 1858	Dublin	Dublin.
Soden, Susannah	1861 to 1865	Metropolitan	
Sonnes, William H.	1855 to 1857	Metropolitan	Birmingham.
Spain, John H.	1877 to 1882	Dover	Tavistock.
Sparkes, John	1855 to 1859	Unconnected	Lambeth, Principal Nat. Art Training School.
Spencer, Augustus	1881 to	Metropolitan	Still in training.

Name.	Period.	Educated at	Appointed to
Spragg, Catherine	1865 to 1866	Metropolitan	
Stannus, Anthony	1852 to 1854	Belfast	Merthyr Tydvil, Bath.
Stanton, G. Clark	1853	Birmingham	
Steel, Margaret	1870 to 1872	Dundee	
Stevenson, Andrew	1857 to 1861	Dundee	Leeds.
Stevenson, Rea J.	1862 to 1869	Halifax	Perth.
Stopford, Wm. H.	1860 to 1863	Cork	St. Martin's.
Sturgeon, William	1862 to 1868	Leeds	Leeds.
Sturtevant, Chas. T.	1853 to 1858	Unconnected	York, Birmingham.
Sullivan, Michael	1864 to 1870	Metropolitan	Kendal, Hastings.
Summerscales, John	1879 to 1883	Hull	Manchester.
Swallow, Jane F.	1856 to 1861	Metropolitan	
Swallow, John C.	1853 to 1874	Metropolitan	York, Leeds, Ryde, Glasgow, Bath.
Swinstead, Charles	1853 to 1855	Metropolitan	Marlborough House.
Sylvester, Henry	1855 to 1858	Metropolitan	Aberdeen.
Taylor, Edward R.	1858 to 1863	Burslem	Wolverhampton, Lincoln.
Taylor, J. B.	1873 to 1878	Metropolitan	Cheltenham.
Teasdale, John	1869 to 1870	Newcastle-on-Tyne	Belfast.
Theaker, George	1867 to 1869	Sheffield	Burslem.
Thomas, Stephen G.	1862 to 1868	Penzance	
Thompson, F.	1874 to 1877	Darlington	Durham.
Thompson, J. C.	1853 to 1855	Unconnected	Warrington.
Thorne, R. C.	1875 to 1880	Gravesend	Cheltenham.
Took, Frederick A.	1872 to 1875	S. Kensington	
Trowbridge, G.	1875 to 1880	Birmingham	Belfast.
Tucker, Raymond	1853 to 1859	Unconnected	Tavistock, Wellington College.
Tucker, William	1867 to 1872	Taunton	Kidderminster.
Tunmer, Harris John	1871 to 1874	Metropolitan	Southampton.
Turner, George	1870 to 1875	Metropolitan	Kendal.
Twynam, Elizabeth	1870 to 1872	Metropolitan	
Underhill, Edward S.	1869 to 1870	Metropolitan	
Urie, Daniel	1854 to 1855	Paisley	Paisley.
Van Bever, Anthony	1853 to 1854	Unconnected	
Wade, George	1875 to 1876	Metropolitan	
Waite, James	1855 to 1856	Newcastle	Newcastle.
Waite, Robert Thorn	1860 to 1863	Cheltenham	
Walford, Amy Isabella	1877 to 1878	Metropolitan	National Scholar.
Walker, James W.	1853 to 1854	Norwich	Birmingham.
Wallis, W.	1875 to 1879	Birmingham	Croydon.

Name.	Period.	Educated at	Appointed to
Walsh, Nicholas	1856 to 1857	Dublin	
Ward, George	1881 to	Devizes	Still in training.
Wardle, George	1855 to 1863	Macclesfield	Devonport.
Watson, Lizzie	18,0 to 1872	Unconnected	
Watson, Thomas	1870 to 1875	Leeds	Dollar.
Watson, William P.	1876 to 1881	Metropolitan	South Kensington.
Way, Charles Jones	1856 to 1858	Metropolitan	Canada.
Way, William Cosens	1856 to 1861	Metropolitan	Wolverhampton, Newcastle-on-Tyne and Sunderland.
Webster, Alfred George	1871 to 1877	Metropolitan	Lincoln.
Wheeler, Sarah Ann	1856 to 1861	Unconnected	
Whitaker, Chas. H.	1854 to 1857	Metropolitan	Birmingham.
White, John	1853 to 1856	Unconnected	Leeds.
White, William	1879 to	Leeds	Still in training.
Whitehead, Arthur	1878 to 1884	Leamington	South Kensington.
Wigzell, Montague	1854	Metropolitan	Exeter.
Wilkinson, Alfred	1883 to	S. Kensington	Still in training.
Williamson, Jas. B.	1853 to 1859	Belfast	Newcastle, Taunton, Female School, Gower Street.
Williamson, Jas. J.	1870 to 1873	Metropolitan	Rossall School, Lancashire.
Willis, Richard H. A.	1877 to 1883	Cork	Manchester.
Wilson, Catherine	1854 to 1855	Metropolitan	South Kensington.
Wilson, Helena	1857 to 1861	Metropolitan	Queen Square.
Wood, Daniel	1861 to 1862	Metropolitan	Cambridge.
Wood, George A.	1877 to 1882	Metropolitan	Hertford.
Woodhouse, F. W.	1883 to	Metropolitan	Still in training.
Woolner, Henry	1856 to 1861	Unconnected	Coalbrookdale.
Woon, Rosa E.	1869 to 1873	Metropolitan	
Wright, Hy. Wm.	1856 to 1858	Unconnected	
Wright, Peter	1878	Unconnected	
Wrigley, William	1857 to 1859	Aberdeen	
Yeates, George P.	1853 to 1854	Unconnected	Stourbridge.
Young, Wm. Allen	1854 to 1856	Dublin	

APPENDIX G.

LIST OF NATIONAL SCHOLARS, PAST AND PRESENT.

Name.	Period.	Where from.	Appointments, &c.
Fildes, S. Luke	1863 to 1865	Warrington	Designer and Draughtsman. (now A.R.A.).
Harris, Joseph	1863 to 1865	Nottingham	Appointed to Salisbury.
Brophy, Andrew	1863 to 1871	Dublin	Designer to Messrs. Trollope; Technical School, Finsbury.
Ford, James	1864	Leeds	Macclesfield School of Art.
Slocombe, Fred. A.	1864 to 1867	Metropolitan	Designer, Artist, and Etcher.
Gandy, Robert	1864 to 1865	Metropolitan	Draughtsman at Northampton.
Wood, Henry	1865 to 1867	Warrington	Draughtsman on *Graphic* (now A.R.A.).
Morris, Rowland J.	1865 to 1871	Burslem	Modeller to Messrs. Wedgwood, Burslem.
Wright, Wm.	1865 to 1868	Burslem	Modeller to Messrs. Blashfield, Stamford.
Chapman, John	1865 to 1867	Metropolitan	Employed by Department as Modeller.
Morrison, Walter Wm.	1865 to 1866	S. Kensington	Employed by Department.
Gibbons, Albert	1865 to 1868	Gloucester	Drowned in Serpentine.
Emms, John	1865 to 1867	Yarmouth	Ecclesiastical Decorator and Animal Painter.
Brewtnall, Edward	1865 to 1867	Warrington	Draughtsman on Wood.
Wise, William	1865 to 1868	S. Kensington	Designer to Messrs. Minton.
Wormleighton, Edward	1866 to 1868	S. Kensington	Designer to Messrs. Trollope.
Lunn, Richard	1866 to 1868	Sheffield	Master at Sheffield.
Simpson, William Page	1866 to 1868	Metropolitan	
Kingman, George	1866 to 1868	Bath	Designer to Messrs. Benton & Lewis, Kidderminster.
Gibbons, Owen	1866 to 1869	Cirencester	Employed by Department.
Marsh, James	1866 to 1867	Stoke	Designer and Modeller, Potteries.
Morgan, George	1866 to 1868	Birmingham	Die Sinker to Messrs. Wyon, afterwards Principal Medallist at Philadelphia Mint.
Mackarness, William	1867 to 1869	S. Kensington	Designer to Messrs. Morris, Queen Square.
Sharpe, Thomas	1867 to 1869	Charterhouse	Designer to Messrs. Morris, Queen Square.
Morrison, Peter	1867 to 1869	Kidderminster	Designer at Kidderminster.
Randall, Wm.	1867 to 1869	Stroud	Designer to Messrs. Hartley & Co., Westminster.
Beesley, James	1867 to 1869	Birmingham	Designer at Birmingham.
Rushworth, Geo.	1867 to 1869	Halifax	Designer to Messrs. Crossley, Halifax.

Name.	Period.	Where from.	Appointments, &c.
Brooke, John	1867 to 1869	Sheffield	Modeller to Rowland Morris.
Mason, Herbert	1867 to 1868	Birmingham	Designer and Modeller at Birmingham.
Galli, Luigi	1868 to 1872	Preston	Preston School of Art.
Cox, Thomas	1868	Birmingham	Designer to Messrs. Hart & Co.
Eyre, John	1868 to 1870	Stoke-on-Trent	Designer to Messrs. Morris, Queen Square.
Perks, Benjamin	1868 to 1871	Kidderminster	Designer.
Kirkman, Wm.	1868	S. Kensington	
Turner, John	1868 to 1870	Sheffield	Designer to Messrs. Walker, Cabinet Makers.
Frost, John	1868	Coventry	
Black, Amy Eliza	1868 to 1869	Metropolitan	Employed by Department as Tile-painter.
Walker, Susannah	1868 to 1869	S. Kensington	Employed by Department as Tile-painter.
Arnold, W. Henry	1869 to 1871	Metropolitan	China Painter to Messrs. Mortlock.
Foster, Herbert W.	1869 to 1871	Nottingham	Employed by Department as Decorative Painter.
Hardgrave, Chas.	1869 to 1871	York	Designer, Whitefriars Glass Works.
Marshall, Wm.	1869 to 1871	Sheffield	Modeller.
Morgan, Walter Jenks	1869 to 1871	Birmingham	Designer of Stained Glass.
Nunn, Walter J.	1869 to 1871	Charterhouse	Designer to Messrs. Button & Sons, Fleet Street.
Smith, Jno. Bates	1869 to 1871	Halifax	Designer to Crossley & Co., Halifax.
Rossiter, Henry	1869 to 1871	Frome	Glass Painter to Messrs. O'Connor, Berners Street.
Wilson, Thos. W.	1869 to 1871	S. Kensington	Wood Draughtsman and General Designer.
Golding, Thos. A.	1869 to 1871	S. Kensington	Glass Painter to Messrs. Heaton, Butler, & Bain.
Morton, Chas. J.	1869 to 1871	Birmingham	Designer to Messrs. Mitchell, Vane, & Co., New York.
Fourness, Wm.	1869 to 1871	Charterhouse	Designer to Messrs. Trollope.
Drake, George E.	1869 to 1871	Halifax	Carpet Designer.
Rhodes, Wm. P.	1869 to 1871	Newcastle	
Marklew, Wm.	1870	Birmingham	
Cope, James	1870 to 1872	Hanley	Modeller in the Potteries.
Rowley, James	1870 to 1872	West London.	Designer to Messrs. Heldbruner, Regent Street.
Reeves, Thomas	1870 to 1872	Birmingham	Employed by Messrs. Dee, or Sherwood.
Clauson, William	1870 to 1872	S. Kensington	Designer to Messrs. Trollope.
Payne, George	1871 to 1873	S. Kensington	Designer to Messrs. Akroyd & Sons, Halifax.
Shaw, John J.	1871 to 1873	S. Kensington	Draughtsman to Messrs. Aitchison, architects.
Simpson, Geo. G.	1871 to 1873	S. Kensington	West London School of Art.
Suter, James W.	1871 to 1872	S. Kensington	
Hodges, Geo. H.	1871 to 1873	Spitalfields	

Name.	Period.	Where from.	Appointments, &c.
Harrison, Joseph	1871 to 1873	Nottingham	Leicester School of Art.
Singer, Walter H.	1871 to 1873	Frome	Designer at Frome.
Emery, Chas. E.	1871 to 1873	Birmingham	Drowned in Thames trying to save life.
Coulson, Matthew	1871 to 1873	Newcastle-on-Tyne	Designer to Messrs. Trollope; West London School of Art.
Gibbons, Edward	1872	Cirencester	Edinburgh School of Art.
Drummond, Geo. D.	1872 to 1874	S. Kensington	Designer to Mr. Heyman, lace manufacturer, Nottingham.
Montgomery, William	1872 to 1874	Newcastle-on-Tyne	Glass Painter to Messrs. Clayton and Bell.
Abraham, Robert	1872 to 1874	Stoke-on-Trent	Designer to Messrs. Copeland, Stoke.
Currie, Sidney D.	1872 to 1874	Birmingham	Designer.
Thomas, Jas. H.	1872 to 1874	Bristol	Sculptor.
Petty, Edward	1872 to 1874	Salisbury	Carpet Designer.
Watkins, John	1873 to 1875	Birmingham	Employed by Department; now Designer in Paris.
Lane, John Q.	1873 to 1875	Belfast	Designer for Damask.
Schenck, Fred. E.	1873 to 1875	Hanley	Art Master, Hanley.
Langley, Walter	1873 to 1875	Birmingham	Water Colour Painter.
Clauson, George	1873 to 1875	S. Kensington	Designer.
Sherlock, John A.	1873 to 1875	Warrington	Designer to Messrs. Simpson.
Humphries, Charles	1874 to 1876	S. Kensington	
Ward, James	1874 to 1876	Belfast	Employed by Department on Sir Frederick Leighton's Cartoon.
Hindley, Charles	1874 to 1875	Coalbrookdale	Art Director in Pottery Works.
Derrick, William	1874 to 1876	Bristol	Bristol School of Art.
Brindley, Charles A.	1874 to 1876	Kidderminster	Designer for Textiles.
Tidmarsh, Hy. E.	1874 to 1876	S. Kensington	Designer.
Edelstein, Alice J.	1874 to 1876	Warrington	
Jameson, Benjamin	1875 to 1877	Warrington	Designer to Messrs. Templeton, Glasgow.
Collins, Charles Edward	1875 to 1877	Birmingham	Designer for Iron Work, Birmingham.
Bloor, Daniel	1875 to 1878	Hanley	Modeller.
Bell, Thomas F.	1875 to 1878	Belfast	Designer for Damask.
Reynolds, Henry	1875 to 1878	Birmingham	Glass Painter and Designer at Birmingham.
Harvey, Henry	1875 to 1878	S. Kensington	Modeller.
Broad, William	1876 to 1878	Worcester	Designer to Messrs. Jackson.
Holgate, Joseph	1876 to 1879	Halifax	Designer.
Phillips, Thomas	1876 to 1878	Belfast	Sydney School of Art.
Singer, Edgar Ratcliffe	1876 to 1879	Frome	Designer, Frome.
Cresswell, Christina F. E.	1876 to 1878	Bristol	Designer for House Decoration.
Rhead, George W.	1877 to 1879	Stoke-on-Trent	Pottery Painter.
Benson, J. Marsh	1877 to 1879	Sheffield	Designer.

Name.	Period.	Where from.	Appointments, &c.
Kennington, Thomas B.	1877 to 1879	Liverpool	Portrait Painter.
McKenzie, Wm.	1878 to 1880	Belfast	Designer for Damask.
Ascough, Edw. W.	1878 to 1880	Birmingham	Dublin School of Art.
Bladen, Thos. W.	1878 to 1880	Newcastle	Designer.
Nicholas, Arthur	1878 to 1880	Coalbrook-dale	Designer.
Rhead, Louis J.	1878 to 1880	Newcastle	Designer, Brooklyn, U.S.
Walford, Amy Isabella	1878 to 1880	S. Kensington	Technical School, Kennington.
Ledward, Richd. A.	1879 to 1882	Burslem	Sculptor.
Marriott, Fredk.	1879 to 1882	Coalbrook-dale	Designer to Marcus Ward & Co.
Hayes, Michael	1879 to 1881	Limerick	Designer to Messrs. Trollope.
Proctor, Joseph	1879 to 1882	Burslem	Charterhouse School of Art.
McKenzie, John	1879 to 1881	Belfast	Designer for Damask.
Drury, Alfred	1879 to 1881	S. Kensington	Modeller, Paris.
Riley, Arthur D.	1879 to 1881	S. Kensington	Sydney School of Art.
Pratt, Wm. B.	1880 to 1882	Cirencester	Designer for Ecclesiastical Furniture.
Bowcher, Alfred W.	1881 to 1883	S. Kensington	Modeller, Terra-cotta Works, Canstock, Cornwall.
Gibbons, Francis	1881	Cirencester	Designer for Pottery.
Morrow, Albert J.	1881 to 1883	Belfast	Wood Draughtsman, Fine Art Society, Bond Street.
Toft, Albert A.	1881 to 1883	Newcastle	Designer.
Bardell, Charles	1881 to 1883	Birmingham	Designer, Stained Glass Works, Birmingham.
Davis, Louis	1881 to 1883	S. Kensington	Designer and Decorator.
Page, John W. E.	1881 to 1883	Lambeth	Employed by Department.
Thomas, W. G.	1881 to 1883	Westminster	Manchester School of Art.
Gater, John	1882	Newcastle-under-Lyme	Designer.
Palin, Wm. M.	1882 to 1883	Burslem	Employed by Department in Italy.
Rhodes, Roland	1882	Newcastle-under-Lyme	Preston School of Art.
Tomlins, Henry J.	1882	Worcester	Examiner of Designs, Patent Office, Chancery Lane.
Steeley, Frank	1882 to 1883	Birmingham	Designer for Silver Plate, Birmingham.
Bradburn, John W.	1882	Coalbrook-dale	Still in training.
Evans, John A.	1882	Gloucester	" "
Roberts, Ellis W.	1882	Stoke-on-Trent	" "
McCormick, Arthur D.	1883	Belfast	" "
Henney, Geo. F.	1883	Birmingham	" "
Abraham, Francis	1883	West London	" "
Gibson, Henry	1883	Preston	" "
Penson, Fredk. T.	1883	Stoke-on-Trent	" "
Leighton, Fredk.	1883	Coalbrook-dale	" "

Name.	Period.	Where from.	Appointments, &c.
Crompton, Edw.	1883	S.Kensington	Still in training.
Gates, Wm. H.	1883	S.Kensington	" "
Fisher, John	1883	Sheffield	" "
Albrow, Oscar R.	1884	Yarmouth	" "
Brown, W. K.	1884	West London	" "
Flowerdew, C. E.	1884	Nottingham	" "
Fisher, Alex.	1884	Torquay	" "
Smith, Thomas	1884	Coalbrook-dale	" "

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